

**KPK BOARD
NOTES**

BIOLOGY

**9TH
CLASS**

Presented by:

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BIOLOGY NOTES FOR 9TH CLASS (FOR KHYBER PAKHTUNKHWA)

CHAPTER

1

INTRODUCTION TO BIOLOGY

Q1: What is biology? List down its major branches.
BISE Mardan 2015, BISE Peshawar 2016

Ans. Biology:

The word "biology" is derived from two words i.e. bio-life and logy-study.

Definition: "The branch of science which deals with the study of life is called biology." In biology we deal with the study of life cycle, habitat, nutrition and behavior of an organism. The word "biology" was discovered by Carl Linnaeus for the first time.

Main Branches of Biology:

There are three main branches of biology:

1. **Botany:**

"The branch of biology which deals with the study of plants is called botany."

2. **Zoology (Zoo-animal, logus-study):**

"The branch of biology which deals with the study of animals is called zoology."

3. **Microbiology:**

"The study of micro organisms is called microbiology."

Micro Organism:

"Those organisms which are only seen under microscope"

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are called micro organisms e.g. bacteria, virus, amoeba etc.

Sub Branches of Biology:

1. Morphology: (Morph-shape, logus-study)

"The study of physical appearance of an organism is called morphology." In this we study shape and structure of an organism.

2. Anatomy:

"The study of internal structure of an organ is called anatomy."

3. Histology: (histos-tissue, logy-study)

"The study of tissue of plants and animals is called histology." In this we study about function, structure and composition of a tissue.

4. Physiology:

"The study of function of a organ is called physiology." e.g. the physiology of kidney is filtration of blood.

5. Embryology: (Embryon-feetus "baby in uterus")

"The study of formation of embryo is called embryology." In this we study how a complete multi-cellular organism is develop from a single zygote.

6. Taxonomy: (Taxis-arrangement, nomy-law)

"The study of classification of organism and giving name to them is called taxonomy." In this we classify organism into groups and sub-groups on the basis of their similarities and differences.

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7. Cell Biology or Cytology: (Cytos-cell, logus-study)

"The study of cell and its organelle is called cytology." In this we study structure, composition and function of a cell.

8. Paleontology: (Paleo-old, onto-existing, logus-study)

"The study of fossil record of ancient organisms."

"The study of life which once was is called paleontology."

For any remanent or impression of the organisms of past life that is preserved in earth.

Paleobotany: "The study of fossils of plants is called paleobotany."

Paleozoology: "The study of fossils of animals is called paleozoology."

9. Immunology:

"The study of immune system of the body is called immunology."

Immune System: "The defense system of a body against harmful substances is called immune system."

10. Entomology: (Entomon-insect, logus-study)

"The study of insects is called entomology."

11. Genetics: (Gene-a heredity unit, itcs-transformation)

"The study of mechanism of transformation of character from parents to offspring is called genetics."

12. Biotechnology: (Bio-life, technology-techniques)

ختم نبوت ﷺ زندہ باد

عظمت صحابہ زندہ باد

السلام علیکم ورحمۃ اللہ وبرکاتہ:

معزز ممبران: آپ کا وٹس ایپ گروپ ایڈمن "اردو بکس" آپ سے مخاطب ہے۔

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- ❖ کوئی بھی ممبر کسی بھی ممبر کو انباکس میں میسج، مس کال، کال نہیں کرے گا۔ رپورٹ پر فوری ریموو کر کے کارروائی عمل میں لائے جائے گی۔
- ❖ ہمارے کسی بھی گروپ میں سیاسی و فرقہ واریت کی بحث کی قطعاً کوئی گنجائش نہیں ہے۔
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- ❖ سب سے اہم بات:

گروپ میں کسی بھی قادیانی، مرزائی، احمدی، گستاخ رسول، گستاخ امہات المؤمنین، گستاخ صحابہ و خلفائے راشدین حضرت ابو بکر

صدیق، حضرت عمر فاروق، حضرت عثمان غنی، حضرت علی المرتضیٰ، حضرت حسنین کریمین رضوان اللہ تعالیٰ اجمعین، گستاخ اہلبیت یا

ایسے غیر مسلم جو اسلام اور پاکستان کے خلاف پراپیگنڈا میں مصروف ہیں یا ان کے روحانی و ذہنی سپورٹرز کے لئے کوئی گنجائش نہیں

ہے لہذا ایسے اشخاص بالکل بھی گروپ جو ان کرنے کی زحمت نہ کریں۔ معلوم ہونے پر فوراً ریموو کر دیا جائے گا۔

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لی جاتی ہے۔ جس میں محنت بھی صرف ہوتی ہے لیکن ہمیں آپ سے صرف دعاؤں کی درخواست ہے۔

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جائے گا۔

نوٹ: ہمارے کسی گروپ کی کوئی فیس نہیں ہے۔ سب فی سبیل اللہ ہے

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اللہ تبارک تعالیٰ ہم سب کا حامی و ناصر ہو

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"The techniques in which we use living organisms for the welfare of human being are called biotechnology."

13. Environmental Biology:

"The study of inter-relation of organism among each other and with their non-living environment is called environment biology."

14. Parasitology: (Parasitos-eating at the expense of other)

"The study of parasites is called parasitology."

Parasites: "Those organisms that obtain their food from living bodies and harm them are called parasites."

15. Socio-Biology:

"The study of social behavior of an organism is called socio-biology." e.g. honey bees, ants and termites.

16. Pharmacology: (pharmakon-drug, logus-study)

"The study of drugs and their effect on human body is called pharmacology."

Drug: "Any substance that can change the physiological or psychological activities of an organism is called drug."

Q2: Explain the linkage between biology with biophysics, biochemistry, biogeography and statistics. BISE Peshawar 2017

Ans. Biology is link with other field of science in different aspects. It is because the metabolism and functioning of living organisms follow the principle

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of physics, biochemistry, geography and economics etc. The linkages are given below:

1- Biophysics:

It is an inter-disciplinary study in which we apply laws and principle of physics to understand a biological phenomena occurring in a body.

Example: Fluid dynamics is applied to blood flow, gas physics is applied respiration and radiation in diagnosis of disease are used. Photosynthesis also follows the laws of physics during absorption of light.

2- Biochemistry:

"The study of biochemical process that occurs inside the body of living organism is called biochemistry." e.g. photosynthesis and respiration.

3- Biogeography:

"The study of distribution of organisms in different regions of the world is called biogeography." Various organisms are found in various region of the world. Some organisms are found all over the world while some organisms are found only in specific regions of the world. e.g.

1. Polar bear is found in arctic region
2. Cats are found all over the world

4- Biometry or Biostatistics:

The study of biological phenomena by using statistical tools and techniques. In this we analyze and interpret the research data.

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5. Bio-Economics: (BISE Abbottabad 2018)

1. It is the co-relation of biology with economics.
 2. It is concern with the use of organism to get money.
 3. In this we compare and calculate the cost and profit of biological projects.
- e.g. a disease of organism can results in loss of billions of dollars throughout the world.

Q3: Explain the different carrier in biology.

Ans. 1. Medicines and Surgery:

The field of medicines is related with the prevention, diagnosis and treatment of human diseases.

Surgery: In surgery a defective part of the body is repaired, replaced or removed. After studying biology at higher secondary level one can choose these professions in the same course (MBBS or BDS).

2. Fishes:

In this field of biology we deals with the habitat, reproduction, disease and nutritional requirements of fishes. When a person do bachelor or master in zoology then it can adopt this carrier.

3. Agriculture (زراعت):

Agriculture is the cultivation of soil for the production of crops and rearing of animals to get food, wool and other products. In Pakistan there are agricultural universities when one can do professional course in agriculture. Agriculturist may work in agriculture department, pharmaceutical industries, farming, veterinary and agricultural bank etc.

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4. Animal Science:

This field is concern with the breeding and development of livestock (domestic animals). Animal science is taught in many universities in Pakistan. It is done after higher secondary education in biology.

5. Horticulture:

It is art of growing and development of plants (gardening). Horticulturist can open business and find job in fruits and vegetable production; landscape design, nurseries and gardens.

6. Forestry:

"The practice of planting, managing and caring of forest is called forestry." Forestry is done to provide wood for timber and a habitat for wild life.

7. Farming:

"The act of growing crops and rearing of animals is called farming." It is concern with animal breeding, poultry, fruits and vegetables.

Q4: Who classify the living organisms? Also explain each kingdom with examples.

Ans. Robert Whittaker in 1969 classified organisms into five kingdoms:

1. Kingdom monera
2. Kingdom protista
3. Kingdom fungi
4. Kingdom plantae
5. Kingdom anamalia

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1- Kingdom M nera:

Also called kingdom prokaryota.

Characteristics:

- 1- *They have prokaryotic cell.*
- 2- *They are unicellular.*
- 3- *They are microscopic (only seen by microscope)*
- 4- *They lack true nucleus and membrane bounded organelles.*
- 5- *Their cell wall is composed of murine.*
- 6- *They are divided by binary fission e.g. bacteria and cyanobacteria.*

2- Kingdom Protista:

It is also called trash can kingdom. It contains various organisms. Some have animal like characters, some have plants and some have fungi like.

Characteristics:

- 1- *They are simplest eukaryotic organisms.*
- 2- *Some are unicellular and some are multi-cellular.*
- 3- *Some are autotrophic while some are heterotrophic.*
- 4- *They may produce spores.*
- 5- *Some members are motile. e.g. paramecium, plasmodium, amoeba etc.*

3- Kingdom Fungi: (BISE Kohat 2015, Swat 2017)

Characteristics: (BISE Mardan 2015, Peshawar 2016)

- 1- *They are eukaryotic organisms.*
 - 2- *They may be unicellular (yeast) or may be multi-cellular (mushroom).*
 - 3- *They produce spores.*
 - 4- *They are non-motile.*
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5. Cell wall is composed of chitin.
6. They are heterotrophic.
7. Food is stored inside the body in the form of glycogen. e.g. yeast, mushroom, molds etc.

4. Kingdom Plantae:

Characteristics:

1. They are eukaryotic cell organisms.
2. They are multi-cellular.
3. They produce spores.
4. They are non-motile (sessile).
5. They have chloroplast so they are autotrophic.
6. Their cell wall is composed of cellulose.
7. The food is stored in the form of starch.
8. They lack centriol.
e.g. all green plants.

5. Kingdom Animalia: (Anima-breath or soul)

Characteristics:

1. They are eukaryotic cell organisms.
2. They are multi-cellular.
3. They are motile.
4. They are heterotrophic.
5. They lack cell wall.
6. Centriols are present in their cells.
7. They store food in the form of glycogen.
e.g. vertebrates and invertebrates.

Q5: Discuss teaching of Holy Quran about biological science.

Ans: Holy Quran and Biological Science:

Allah Almighty is the creator of whole universe. In many verses of Holy Quran Allah explains the

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creation of human beings - some are given below:

1. Allah created man from the sounding clay like the clay of pottery.
2. In Surah-Al-Mominoon Ayah: 14 Allah says "we make a clot of congealed blood from sperm. Then from this clotted blood mass we make lump that is fetus. From that lump (cartilage) we make bone. To that bone we clothed it with meat (muscle) and then at last we create a complete human being. So Allah is the best creature."
3. In Surah-Al-Sajda Ayah: 7 Allah says "we made all things good which he created, and He began the creation of man from clay."
4. In Surah-Al-Zumar Ayah: 62 Allah says "Allah is the creator of all things and He is guardian over all things."
5. In Holy Quran Allah says "we create everything from water. Some of them are creeping on their bellies, some are bipedal while some are walking on four legs."

Q6: What are the contribution of Muslim scientist in the field of biology?

Ans: Contribution of Muslim Scientist:

From 8th - 15th century Muslim scientist contribute a lot of knowledge to the biological science and medicines. Their views were highly respected and taken as authority. Some of the famous are given below:

1. **JABIR BIN HAYAN:** (BISE Malakand, Kohat, Swat 2015, Peshawar 2016)

He was born in Iran (721 AD). He is known as the

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father of chemistry. He was an astronomer, physician, philosopher, engineer and scientist.

Contribution:

1. *He introduced experimental chemistry.*
2. *He wrote a number of books on plant "Al-Nabatat". In this book he explains form, shape and function of plant.*
3. *He wrote a book on animals called "Al-Hayawan".*

2. ABDUL-MALIK ASMAI:

He was born in Busra in 740 A.D. he was regarded as a specialist in animal science.

Contribution:

1. *He wrote many books on plants and animals.*
2. *He wrote a book about horses which is called "Al-Kheil".*
3. *He wrote a book about camel which is "Al-Ibil".*
4. *He also wrote a book about sheep "A-sha" and "Al-Wahoosh" about wild animals.*
5. *He also wrote a book about different parts and functions of human body called "Khalaq-ul-insan".*

3. BU-ALI SINA:

He was born near Bukhara in 980-1037 AD. He was among the greatest Muslim scientists.

Contribution:

1. *He wrote a lot in the field of medicines.*
 2. *He was also expert in astronomy, mathematics, physics and paleontology.*
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3. He works on the structure and function of human eye and its diseases. In this book he explains 130 diseases of eye.

4. ABU-USMAN UMAR ALJAHIZ:

He was born in Busra.

Contribution:

1. He wrote a famous book on animal called "Al-Haywan". In this book he describes his own observation on animals such as seasonal migration of fishes in rivers.
2. He also describes the life system of ants.

5. AL-FARABI:

He was born in 870 AD. He was a biologist.

Contribution:

1. He wrote two books; "Kitab-ul-Nabatat" this book was about plants.
2. "Kitab-ul-Hayawanat" this book was about animals.

6. ABDUL QASIM ALI ZAHRAVI:

(BISE Bannu 2017)

He was born in 936 AD.

Contribution:

1. He was a great Muslim surgeon.
2. He was famous for the removal of kidney stone from urinary bladder.

7. IBN-UL-HAITHUM:

He was born in 965 AD. He was one of the most outstanding biologist of the Muslim world.

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Contribution:

1. He was an ophthalmologist.
2. He corrected Greek concept of vision locating retina as the seat of vision.
3. He wrote two books "Kitab-ul-Manazir" and "Mizan-ul-Hikma" which were translated into Latin.

8. Ali Bin Isa:

He was a well known ophthalmologist.

Contribution:

1. He explains the structure, function and diseases of eye.
2. In this book he describes 130 diseases of eye.

9. IBN-UL-NAFEES:

He was born in 1213. He was a renowned biologist of 13th century.

Contribution:

He describes the circulation of blood in human body.

Q7: Explain various levels of biological organization.

Ans: Levels of Biological Organization:

1. In present time million organisms are living on the earth.
 2. These organisms are different from each other -
— they ranges from simplest organism (bacteria) to complex organisms (human).
 3. The bodies of these organisms are made of different parts which are organized in a good manner. i.e.
atom → molecules → organelle → cell → tissue
→ organs → organ system → organism.
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Sub-Atomic Particles and Atoms:

1- ATOM:

It is the smallest particle of an element. (OR)

The building block of element is called element.

Each atom is composed of sub-atomic particles i.e. electron, proton and neutron.

Element: When atoms combine together they form element.

Bio-Element:

"Those elements which are present in the body of living organisms are called bio-element." There are 16 bio-elements. Only 6 of them make the 99% protoplasm - these elements are O, C, H, N, Ca and P. Other 10 elements are collectively make 1% protoplasm. These are K, S, Cl, Na, Mg, Fe, Cu, Mn, Zn and I.

2- MOLECULE:

When atoms of bio-element combine together they form molecule. This combining of bio-element form bio-molecules.

Types of Molecule:

There are two types of molecules:

a) Micro Molecule:

"Those molecules which have low molecular weight are called micro molecules." e.g. amino acid, glucose and water etc.

For your Information:

Molecules having more than 10000 Dalton weight are considered as macro molecule.

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b) Macro Molecule:

"Those molecules having high molecular weight are called macro molecules." e.g. starch, glycogen and protein etc.

3. COMPOUND:

"The chemical combination of two or more than two different atoms in a fix ratio by mass is called compound."

Types of Compound:

a) Organic Compound:

"Those compounds which contain carbon and hydrogen are called organic compound." e.g. carbohydrate (C, H, O)

b) Inorganic Compound:

Those compounds in which carbon is not directly bonded to hydrogen e.g. water (C, H, O).

4. ORGANELLES:

These are sub-cellular particles that are made by the combination of different bio-molecules. Each organelle performs a particular function in a cell. e.g. mitochondria, endoplasmic reticulum and ribosome etc.

5. CELL (خلیہ):

It is a unit surrounded by membrane. It is the basic structural and functional unit of life. In unicellular organism one cell makes the whole body. In multi-cellular organisms there are more levels of biological organization.

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6. TISSUE:

When similar cells combine together they form tissue. A tissue performs a specific function.

Example: In plants mesophyll performs photosynthesis. In animals glandular tissues is made of cells that produces secretion.

7. ORGAN:

When different tissues combine together and perform a specific function. It makes an organ. e.g. stomach is made of tissue which is made of two types of cells i.e. epithelial tissue and muscular tissues.

8. ORGAN SYSTEM:

When different organs co-ordinates in their function it makes an organ system. e.g. circulatory system is made of arteries, veins and heart.

9. ORGANISM:

When different organ system combines together and works coordinately an organism is formed.

Example: An organism contains respiratory, nervous, circulatory, reproductive and digestive system.

Levels Higher than Organisms:

1. Specie:

A group of similar organisms that can interbreed freely and having the potential to produce fertile offspring is called specie. Same specie have constant number of chromosomes e.g. human = 46.

2. Population:

A group of same specie living together in same area

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is called population. e.g. a field of mustard plant.

3. Community:

"A group of different population living together in same area is called community." e.g. a field of mustard, wheat and grasses.

4. Ecosystem:

An area where living organisms interact with each other and with their non-living environment.

5. Biosphere: (Bio-life, sphere-place)

"The place in universe where life is possible is called biosphere." e.g. atmosphere, lithosphere and hydrosphere.

QB: Discuss different types of cellular organization.

Ans. Cellular Organization: (BISE Swat 2017)

"The organization or arrangement of cell to make an organism is called cellular organization."

Types:

Cellular organizations are of three types:

1. Unicellular
2. Multicellular
3. Colonial

1. Unicellular Organization (ایک خلوی جاندار): (uni-one, cellular-cell)

1. Those organisms which are made up of only one cell are called unicellular organisms.
 2. There one cell can perform all the activities of life such as metabolism, excretion, respiration and movement etc. e.g. amoeba, bacteria etc.
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2. Multicellular Organization (کثیر خلوی جاندار):

(multi-many, cellular-cell)

1. Those organisms which are composed of many cells are called multicellular organisms.
2. In multicellular organisms each cell can perform a specific function. So there is division of labour among the cells. e.g. mustard plant and frog.

Mustard Plant: Its botanical name is "Brassica Compestris". Their body is divided into two types of organs:

1. Vegetative Organ: Root, stem and leaves
2. Reproductive Organ: Flower is the reproductive organ of mustard plant.

Frog (Rana Tigrina): The body of frog is made of different organs and systems. e.g. respiratory system, digestive system, circulatory system and nervous system.

3. Colonial Organization:

These organisms are live in the form of colonies. e.g. volvox.

Volvox:

1. It is a green algae that lives in fresh water.
 2. It belongs to kingdom protista.
 3. The colony of volvox is called coenobium which is made of hundred of cells.
 4. In the colony of volvox two types of cells are present.
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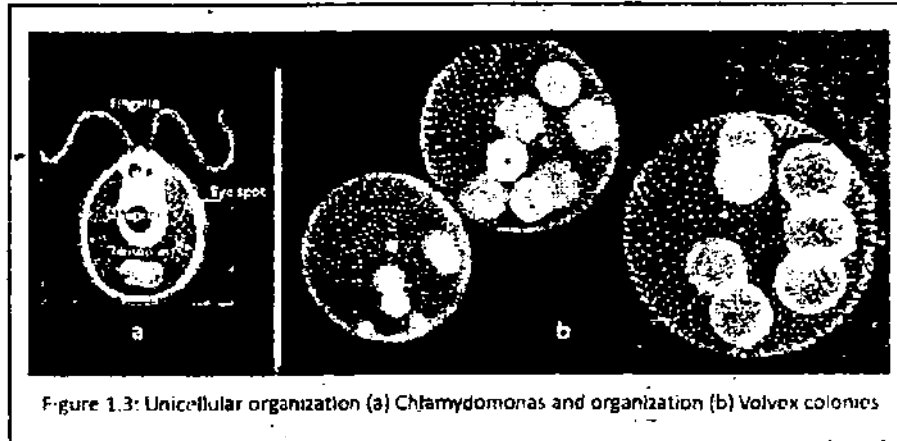
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Vegetative Cell: It is for motility.

Reproductive Cell: It reproduces new volvox.



EXERCISE

A. Encircle the best suitable answers:

1. Ms. Aisha was busy in dissecting and analyzing the heart of frog. Probably she is a:
(a) Cell biologist (b) Taxonomist
✓ (c) Histologist (d) Palaeontologist
2. How many people get lung cancer by smoking?
This question can be answered through:
✓ (a) Biometry (b) Biophysics
(c) Bio-economics (d) Biogeography
3. Al-Qanun fil-Tibb is the famous book of:
✓ (a) Bu Ali Sina
(b) Jabir Bin Hayyan
(c) Abdul Malik Asmai
(d) Ibn Nafees
4. One of the following contains large number of cells but not a multicellular.
(a) Frog ✓ (b) Volvox
(c) Mushroom (d) Chlamydomonas
5. According to five kingdom system of classifications mushrooms belong to:
(a) Plantae ✓ (b) Fungi
(c) Animalia (d) Protista
6. The level of organization which is represented by the heart of frog is:
✓ (a) Organ (b) Tissue
(c) Organism (d) Organelle
7. One of the following is not a macromolecule:

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- ✓ (a) Glucose (b) Sucrose
(c) Fatty acid (d) Protein
8. "The number of plants in desert are scarce".
This could be the statement of:
(a) Palaeontologist (b) Social biologist
✓ (c) Biogeographist (d) Taxonomist
9. Which bio-element makes most of the
composition of organism's body?
(a) Hydrogen (b) Carbon
✓ (c) Oxygen (d) Nitrogen
10. Which of the following cellular organization
represents volvox?
(a) Unicellular (b) Multicellular
(c) Bicellular ✓ (d) Colonial

Short Questions

B. Write short answers for the following questions:

Q1: How the understanding of physics can help the biologist?

Ans: The laws of physics are applied to understand various biological functions. Such as bioenergetics follows the laws of light radiation and fluid dynamics is applicable for the transport of blood in a living body.

Q2: Which career would you like to adopt after studying biology and why?

Ans: I will prefer horticulture if I am a biology student because gardening has many useful aspects such as it provides us delicious food, a place for

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enjoyment, it provides natural beauty to an area and also as a place of playing with children.

Q3: Write the translation of any three verses of the Holy Quran related to the creation of mankind.

Ans.

1. He created human from the sounding clay like a clay of pottery.
2. He created man from filthy (نَجَسَ) water.
3. Allah created man from the product of wet earth.

Q4: Name few Muslim scientists and their contribution in the field of biology and medicine.

Ans. 1. Bu Ali Sina: He was among the greatest Muslim scientists.

Contribution:

1. He works a lot in the field of medicines.
2. He works on the structure and function of human eye.
3. He also discusses diseases of eye.

2. Abu Usman Umar Aljahiz:

1. He works a famous book on animals "Al-Hayawan".
2. He describes the seasonal migration of animals e.g. fishes.
3. He describes life system of ants.

3. Ibn-ul-Haithum:

1. He was an ophthalmologist.
 2. He corrects the Greek concept of vision located retina in the seat of vision.
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Q5: What level of organization is represented by volvox?

Ans: Volvox represents colonial organization. In the colony of volvox many volvox members are found. It may be from 500 - 6000. There are two types of organisms in the colony of volvox i.e. vegetative and reproductive.

Long Questions

C. Write detailed answers for the following questions:

Q1: How the understanding of biology can be improved through the knowledge of geography, chemistry and statistics? Give examples.

Ans: See Question number 3.

Q2: Define biology. How can you describe your own body under different branches of biology?

Ans: See Question number 1.

Q3: Enlist the various levels of biological organization and explain it with an example.

Ans: See Question number 17.

Q4: Explain the role of bio-elements for living organisms.

Ans: Role of Bio-elements for Living Organisms:

1. C, H and O make bio-molecules such as carbohydrates, fats and protein.
2. These molecules form various body structures such as membranes.

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3. These membranes provide shape and protection to the cell.
4. These bio-molecules are also a source of energy for living organisms.
5. H, O and N make proteins.
6. Iron (Fe) is essential for the formation of hemoglobin that transports gases.
7. Ca is essential in muscle contraction and also provides strength to bone and teeth.
8. Na and K are acts to sends impulse in neuron that sense us about a stimulus.

Q5: Who classify the living organisms into five kingdom? Explain each kingdom with the living organisms included in it.

Ans: Please Question number 4.

❖ اپنے آپ کو سب سے بہتر سمجھ لینا جالت ہے۔

❖ ماں کے بغیر گھرا ایک قبرستان ہے۔

❖ ماں جنت کا دوسرا نام ہے۔

SOLVING A BIOLOGICAL PROBLEM

Q1: What is science? How does it work?

Ans. Science:

The study of physical and natural world using theoretical models and data from experiment or observation. By causing scientific method scientists find out the cause and effect of physical and natural relationship of the world. Due to science we solve many problems around us.

Q2: What is biological method? Also explain its steps.

Ans. Biological Method: (BISE Abbottabad)

It is a method through which a person can solve biological problem (disease).

Biological Problem:

"Any problem (disease) in the body of living organisms is called biological problem."

Steps of Scientific Method:

To solve a biological problem, scientists use the following steps:

(i) Recognition of Biological Problem:

It begins with the formulation of a question re-

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lated to a problem. Example: what is the risk factor of lung cancer?

(ii) Observation:

1. The act of observing a thing by five senses.
2. Observation can help a person in finding a solution.
3. In this we collect a data from an object by some tools like microscope.

Observations are of two types:

1. Qualitative
2. Quantitative

Qualitative	Quantitative
1. It deals with description.	It deals with number.
2. It can be only observed.	It can be observed.
3. It is not measured e.g. color, taste and smell.	It can be measured e.g. length, height, tempera- ture etc.

(iii) Hypothesis:

1. A suggested answer to a problem is called hypothesis.
2. It is only a possible answer to a problem.
3. It may be true or may be false.

Characteristics of Good Hypothesis:

1. It is based upon observation.
 2. It is testable through experiment.
 3. It is a proposed statement to answer the problem.
 4. There is always a way to disprove the hypothesis after experimentation.
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Explanation:

1. For a single problem biologist may make more than one hypothesis.
2. There is a need to test all hypothesis for the selection of true one.
3. This testing is done by experimentation.
4. Before going to experimentation a biologist will make deduction for each hypothesis.

(iv) Deduction:

"The logical consequence of hypothesis is called deduction."

1. For making deduction the biologist takes hypothesis as true and draw out the expected results which is called deduction.
2. Deduction involves the use of "if" and "then".
3. If all birds have wings than pigeon is a bird.

(v) Experiment:

"The act of conducting investigation is called experiment."

1. In this a scientist can verify the data of hypothesis.
2. It is the most important step of biological method.

Explanation:

1. Biologist performs experiment and check the deduction on his hypothesis.
 2. If hypothesis proves correct than it is accepted and if proves to be incorrect then it is rejected.
 3. From the accepted hypothesis biologist performs further experiments and confirm the
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correctness of hypothesis.

4. If the result of experiment do not support any hypothesis then a new hypothesis are developed and tested.

(vi) Conclusion and Reporting:

1. Biologist collects data from his experiment and analyzed it statistically to reach some conclusion.
2. Then he publishes his conclusion in the form of research article in scientific journal and books.
3. He also presents his conclusion in science seminars at national and international levels.

Q3: Explain how biologists use scientific method to solve a biological problem?

Ans. Malaria is a biological problem. Malaria: mal-bad, aria-air.

It is a disease characterized by fever and chills. Biologist performs the following steps to solve malarial problems:

(i) Observation:

The physicians of ancient time had some observation on malaria i.e:

1. This disease is common among those peoples who lived in marshy places but when some volunteers drank the water from marshes. They did not develop malaria so a new observation was made i.e. the disease did not result by drinking the water of marshes.
 2. Some people think that stagnant water of
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marshes poison the air. When people breath in this "bad air" they got malaria. But these observations did not help much to solve the problem i.e. cause of malaria.

Observation of Laveran:

In 1878 a French physician Laveran works on the blood of malarial patient under microscope. He seen some micro-organisms in this blood and named as "animaculis" which was later called plasmodium. He won the noble prize for his discoveries.

(ii) Hypothesis:

Plasmodium is the cause of malaria. On this biologist further built a hypothesis.

(iii) Deduction:

For testing hypothesis through experiment biologist made deduction. If plasmodium is the cause of malaria, then all malarial patients should have plasmodium in their blood.

(iv) Experiment:

To test hypothesis that plasmodium is the cause of malaria biologist perform the following experiments:

- 1. They examined the blood of 100 malarial patients. under microscope and was labeled as "experimental group".*
- 2. They also examine the blood of 100 healthy persons under microscope and labeled as "control group".*

(v) Results:

It was observed that plasmodium is the cause of

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malaria because all the persons that have malaria contain plasmodium in their blood.

BIOLOGICAL PROBLEM # 2:

How is plasmodium transmitted to human beings?:

For the solution of this problem biologist performs the following observations:

(i) Observation:

Malaria is associated with marshy places.

Observation of A.F.A King:

In 1883 an American physician A.F.A King 20 more observations about malaria. Some of them are given below:

- 1. People who slept outdoors suffer from malaria more than who slept indoor.*
- 2. Those individual who slept near a smoky places did not get malaria.*
- 3. People who uses mosquito net less suffer from malaria then people who did not use nets.*

(ii) Hypothesis:

On the basis of above observation A.F.A King made a hypothesis that "mosquitoes transmit plasmodium". In order to check the hypothesis the following deduction was made:

"If mosquito transmits plasmodium then plasmodium should be present in the body of mosquito."

(iii) Experiment:

In 1880s a British physician Ronald Ross performs his experiment on sparrows.

- 1. He allowed a female culex mosquito to bite a*
-

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sparrow suffering from malaria.

2. *He killed some of mosquito and studied them.*
3. *He found that plasmodium multiplied in the walls of stomach of mosquito.*
4. *Then these plasmodium moves to salivary gland from stomach.*
5. *He allowed the infected mosquito to bite a healthy sparrow.*
6. *Ross found that these healthy sparrow got malaria.*
7. *At last when he examined the blood of these previously healthy sparrows he found many plasmodium in it. Hence it is cleared that mosquitoes carry plasmodium.*

Experiment on Human Being:

1. *In 1898 an Italian scientist allowed an anopheles mosquito to bite a malarial patient.*
2. *The infected mosquito is then allowed to bite a healthy man.*
3. *This person later becomes a malarial patient.*
4. *So it was confirmed that mosquitoes transmit plasmodium and are involved in the spread of malaria.*

Q4: Explain theory, law and principle.

Ans. Theory:

"A well established explanation of some aspect of natural world is called theory."

When a hypothesis is proved by many experiments then scientists try to develop more new hypothe-

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sis. If this new hypothesis is again proved true then the original hypothesis become theory.

Law:

1. The world wide acceptance of a theory is changed into law.
2. If a theory remains for many years and no change occurs in it then it becomes a law. e.g. Mendel laws and Hardy-Weinberg law.

Q5: What is the importance of data organization for getting an answer to scientific question?

Ans. Data:

1. Any recorded observation is called data.
2. It helps the scientist to make hypothesis from observation and to conclude results from experiment.
3. Data may consist of numbers, words, names and images etc.

Data Organization and Analysis:

1. In scientific method, scientist organized the collected data in the form of graphs, maps, tables, flow charts and diagrams.
2. The collected data is analyzed by using statistical method like ratio and proportion.

Q6: Discuss ratio and proportion.

Ans. Ratio:

"The relation between two things with respect to their comparative quantity is called ratio." Ratio is

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a relationship with respect to relative size between two quantities of same kind. Such as a number of people to a number of people or an amount of money to an amount of money. Ratio is represented by two dots ":" e.g. a:b or 1:3.

Proportion:

1. Proportion means to join two equal ratios.
2. Proportion is the ratio of one thing to another.
3. It is represented by (-).

Explanation:

$$a : b = c : d$$

"a" and "d" are called extreme while "b" and "c" are mean.

a = 1st proportion

b = 2nd proportion

c = 3rd proportion

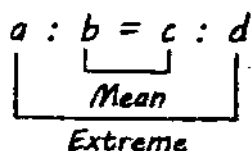
d = 4th proportion

If three proportions are available we can find the 4th one.

Example:

If a biologist wants to know that how many sparrows would be infected with malaria if he allows culex mosquitoes to bite 50 sparrows. Previously he allowed culex-mosquitoes to bite 10 sparrows. 6 out of 10 sparrow got malaria.

$$a : b = c : d$$



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$$a = ?, b = 50, c = 6, d = 10$$

putting values,

$$a : b = c : d$$

$$a \times 10 = 50 \times 6$$

$$a \times 10 = 300$$

Dividing by 10 both sides

$$\frac{a \times 10}{10} = \frac{300}{10}$$

$$a = 30$$

Q6: Explain how mathematics is integral part of science?

Ans. Mathematics is Integral Part of Science:

Mathematics have important role in different fields of science. The mathematical rules are used in biology for many years.

Example:

The research projects, such as population studies, drug studies and sequencing of DNA of plants and animals require mathematical knowledge for organizing and analyzing the data.

﴿اقوالِ حکمائے عرب﴾

❖ لوگوں کو ایک جیسی طبیعت کا خیال نہ کرے کیونکہ ان کی طبائع اور رنگ اتنے ہیں جتنے تو شمار نہیں کر سکتا۔

❖ جن بھلائیوں کو طلب کرتا ہے ان میں سستی کو چھوڑ دے کیونکہ ست شخص نیکیوں میں کامیاب نہیں ہوا کرتا۔

EXERCISE

A. Encircle the best suitable answers:

1. Which one is the first step in biological method?
(a) Hypothesis
(b) Experiment
✓ (c) Observations
(d) Deduction
 2. What is the correct experiment to know plasmodium destroys red blood cells?
(a) Examine the blood of a single healthy person
(b) Examine the blood of a single infected person
(c) Allow mosquito to bite a healthy person and examine his blood
✓ (d) Examine the blood of some healthy and also some infected person
 3. What is the best way to analyze the data collected from experiments?
(a) Reading the data and drawing conclusions
(b) Discussion with scientists
(c) Simple calculations on calculator
✓ (d) Application of statistical formulae
 4. People who slept near smoky fire had less chance to suffer from malaria. Why?
(a) Smoke kills plasmodium in their blood
(b) Fire increases temperature and plasmodium are killed in air
✓ (c) Mosquitoes cannot tolerate smoke and are repelled
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- (d) *Smoke kills plasmodium present in mosquitoes*
5. *which one of the following is NOT a characteristic of a hypothesis?*
- (a) *It must be consistent with all available data*
 - (b) *It must be testable*
 - ✓ (c) *It must be correct*
 - (d) *Must make deductions*
6. *Deductions are made from:*
- (a) *Observations*
 - ✓ (b) *Hypothesis*
 - (c) *Experiment results*
 - (d) *Solution of biological problem*
7. *Which one of the following is true about the statement of hypothesis?*
- (a) *Logical*
 - ✓ (b) *Possible answer*
 - (c) *Based upon observations*
 - (d) *All of them*
8. *The actual answer to scientific problem is:*
- (a) *Observations*
 - (b) *Hypothesis*
 - (c) *Data*
 - ✓ (d) *Conclusion*
9. *Which mosquito can transmit plasmodium in human beings?*
- ✓ (a) *Anopheles*
 - (b) *Culex*
 - (c) *Aedes*
 - (d) *All of these*
10. *For the first time, who found plasmodium in*

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the blood of malarial patient?

(a) Ronald Ross

✓ (b) Laveran

(c) A.F.A. King

(d) Mendel

Short Questions

B- Write short answers for the following questions:

Q1: What is a science? How does it work?

Ans- "The study of physical and natural world using theoretical models and data from experiment or observation is called science."

By using scientific method scientist find out the cause and effect of physical and natural relationship of the world.

Q2: Control group is important for scientific study, how?

Ans- Control group is important for scientific study because a scientist compare the results from the experimental group with the results of control group to see what happens when you change the variable you want to examine.

Due to control group a scientist can find the acceptable result of the experiment.

Q3: What deductions were developed during the study of malaria?

Ans- The following deductions were developed during the study of malaria:

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1. If plasmodium is the cause of malaria then all malarial patients must have plasmodium in their blood.
2. If mosquitoes are involved in the transmission of malaria then plasmodium should be present in the bodies of mosquitoes

Q4: How Ronald Ross conducted the experiment to prove that mosquitoes are involve in the spread of malaria?

Ans. In 1880, Ronald Ross who was a British army physician performs his experiment on sparrow.

1. He allows a culex mosquito to bite a sparrow suffering from malaria.
2. The he allowed this mosquito to bite a healthy sparrow.
3. The healthy sparrow becomes ill with malaria.
4. When he tests the blood of healthy sparrow he find plasmodium in the blood of a sparrow.
5. From this he found out that mosquito transmits and cause malaria in sparrows.

Q5: At what stage of the biological method, hypothesis is accepted or rejected?

Ans. At experimental stage of scientific method a hypothesis is accepted or rejected.

1. If the hypothesis is accepted it is tested again and again.
 2. If the hypothesis is rejected so a new hypothesis is formed.
- =====

Long Questions

C. Write detailed answers for the following questions:

Q1: Differentiate between inductive reasoning and deductive reasoning.

Ans. Inductive Reasoning:

A type of reasoning in which we moves from specific to general, for example; if pigeon has wing and it is a bird then all birds will have wings.

Deductive Reasoning:

In this type of reasoning we moves from general to specific, for example; if birds have wings and pigeon is a bird then it must have wings.

Q2: Explain how biologists use scientific method to solve the mysteries of addressing the malarial problem?

Ans. Please see Question number 3.

Q3: Explain that how mathematics can be used to interpret the data obtained through experimentation?

Ans. Please see Question number 6.

❖ بازار میں ہر چیز مسل جاتی ہے لیکن ماں اور ماں کا پیار نہیں ملتا۔
❖ زندگی استاد سے زیادہ سخت ہوتی ہے۔ استاد سبق دے کر امتحان لیتا ہے
اور زندگی امتحان لے کر سبق دیتا ہے۔

BIODIVERSITY

Q1: Discuss biodiversity. (BISE Swat 2019)

Ans. Biodiversity: (Bio-life, diversity-difference)

"The variety of organism present on the earth is called biodiversity." (OR)

"The difference among living organisms as regarded to their size, shape, structure, behavior and reproduction etc is called biodiversity."

Explanation:

Biodiversity is not uniformly distributed on the world. The biodiversity of an area depends upon on its climatic condition and composition of soil.

1. Tropical region of the earth have richer biodiversity as compare to polar region.
2. Biologists estimated that there are more than 100 million species on the earth.

Q2: What are the importance of biodiversity?

Ans. Importance of Biodiversity:

Following are some importance of biodiversity:

(i) Food for Human Beings:

1. Biodiversity such as plants and animals gives us food.
2. From plants i.e. crops gives us a variety of

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vegetables and fruits.

3. From animals we get meat and milk.

(ii) Production of Drugs:

Various drugs are obtained from plants and microbes:

1. From plants such as quinine are obtained from cinchona tree.

2. From bacteria we get antibiotics such as streptomycin, neomycin and erythromycin.

3. From fungi i.e. penicillium we obtain penicillin.

(iii) Industrial Benefits of Biodiversity:

From plants we get various industrial products such as fibers, dyes, resin, gums, rubber and oil etc.

(iv) Relation with Ecosystem:

1. Biodiversity plays important role in maintaining ecosystem.

2. In an ecosystem each species has a specific role.

3. Loss of species makes the ecosystem less productive.

4. In the ecosystem various biochemical cycles are running such as nitrogen and water cycle.

5. Fertility of soils, balance climate and numerous other factors depend on its biodiversity.

Q3: Define classification? Write the basis of classification. (BISE Abbottabad 2014)

Ans: Classification:

"The arrangement of organisms into groups and sub-groups on the basis of similarities and differences is called classification."

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Explanation:

Biologists have identified and described about 2 million of different kinds of organisms.

Plants = 0.5 million

Animals = 1.5 million

To study such large number of organisms biologists classify organism into different groups.

Basis of Classification (درجہ بندی کی بنیاد):

Biologists classify organism on the following basis:

1. On the Basis of Habitat:

Aristotle classify organisms on the basis of its habitat i.e. organism live in air, soil and water etc. However it is not justifies as animals in one group may have nothing in common except their habitat. e.g. fishes and turtle cannot be placed in one group.

2. On the Basis of Physical Character:

Later biologists classifies organism on the basis of physical characters. Some are given below:

1. Prokaryotic or eukaryotic
2. Unicellular or multi-cellular
3. Autotrophic or heterotrophic

Modern System of Classification:

Modern system of classification is based on genetics, anatomy, physiology and evolutionary history.

Q4: What is the aim of classification?

Ans: The aims of classification of organisms are given below:

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1. To find out similarities and differences among organism for easy study.
2. To provide an idea about sequence of evolution from simpler to complex.
3. To study endangered species.
4. To express relationship based on common features.
5. To classify organisms on the basis of similarities.
6. To name and place the organism in a proper group.

Q5: Discuss principles of classification.

Ans. Principles of classification are given below:

1. Organisms are classified on the basis of apparent similarities among them.
2. If the organisms have more homologous structure they are placed in one group.
3. The anatomical features and evolutionary history are also considered during classification.

Q6: What is hierarchy of classification? Discuss its various categories.

Ans. Hierarchy of Taxonomy: The method of arranging various organisms into successive level of biological classification i.e. from species to kingdom or vice versa.

Explanation:

This system of classification was given by a Swedish naturalist Carolus Linnaeus. Hierarchy of taxonomy is composed of many categories in which the smallest is specie and largest is kingdom.

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Taxonomic Categories:

1. Specie (s): (BISE Abbottabad 2018)

"A group of similar organism which can interbreed freely and having the potential to produce fertile offspring is called specie." The member of a specie have same number of chromosome e.g. all human have 46 chromosomes.

2. Genus:

A group of different species which have some similar character make a genus e.g. human and monkey have same genus i.e. homo.

3. Family:

When different genera are group together having some similar characters makes family.

4. Order:

When different families are group together having some similar character forms order.

5. Class:

When closely related order combine together having some similar characters they form class.

6. Phylum:

When different classes combine together having some similar characters forms phylum.

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7- Kingdom:

When different phylum are grouped together they form kingdom. It is the largest category of classification.

Kingdom

Phylum

Class

Order

Family

Genus

Species

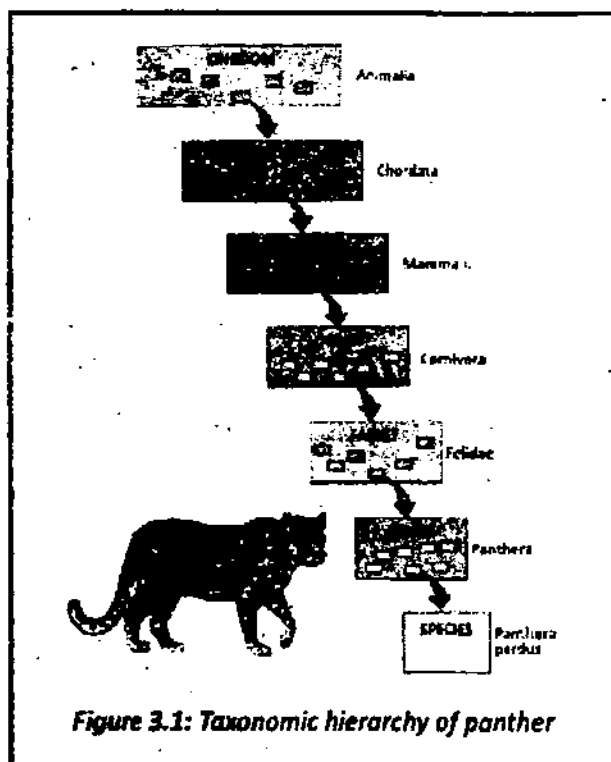


Figure 3.1: Taxonomic hierarchy of panther

**Q7: Discuss history of classification.
(BISE Malakand 2018)**

Ans: History of Classification:

(i) Aristotle Classification System:

(BISE Abbottabad 2018)

1. Aristotle was a Greek philosopher and scientist.
2. He classified animals and plants on the basis of similarities.
3. He and his student (Theophrastus) classified animals into aquatic and terrestrial animals.

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4. He also classifies plants as herbs, shrubs and trees.

(ii) Two Kingdom System of Classification:

1. The two kingdom classification was given by a Swedish scientist named Carolus Linnaeus in 1753.
2. He classifies all the organisms into two kingdoms:
 - a. Kingdom Plantae: It includes all green plants, algae, fungi and bacteria.
 - b. Kingdom Animalia: It includes all unicellular and multi-cellular organisms.

Limitation of Two Kingdom System:

1. Euglena is placed in kingdom plantae. It have both plant and animal like characters i.e. it posses chlorophyll which is plant like as well as it lack cell wall and are heterotrophic in dark. Hence euglena should be kept in separate kingdom.
2. This system cannot give us the idea of prokaryotes and eukaryotes.
3. They kept fungi in kingdom plantae but new discoveries proved that fungi are very different from plants because fungi are heterotrophic and plants are autotrophic.

Ernst Haeckel proposed a new kingdom i.e. kingdom protista to include euglena like organisms.

(iii) Five Kingdom Classification System:

This system of classification was proposed by Ro-

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bert Whittaker in 1969. He classified all living organisms into five kingdoms:

- 1. Kingdom monera.*
- 2. Kingdom protista*
- 3. Kingdom fungi*
- 4. Kingdom plantae*
- 5. Kingdom animalia*

(iv) Margulis and Schwartz Classification System:

In 1988 Margulis and Schwartz classified organisms on the basis of cellular structure, mode of nutrition and method of reproduction.

Q8: Explain the characteristics of five kingdom system of classification. (BISE Malakand 2014)

Ans. (i) Kingdom Monera:

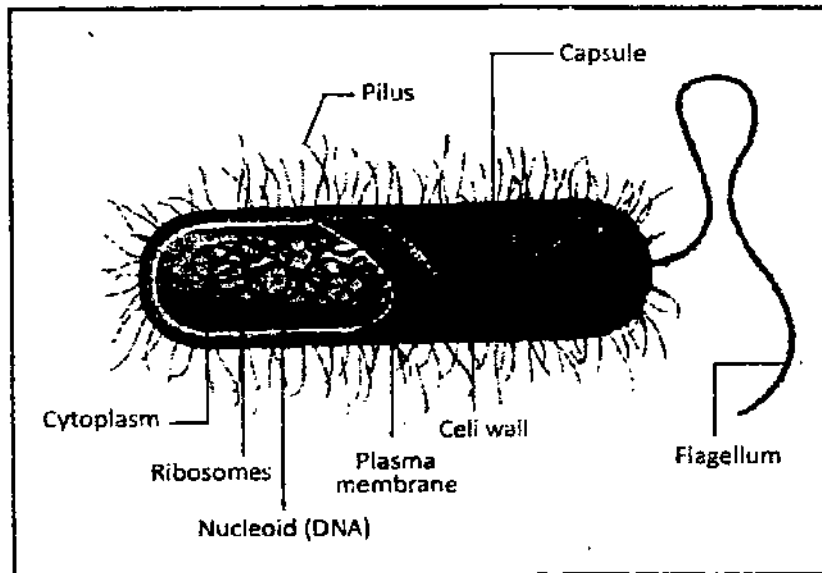
It contains all prokaryotic cell organisms.

Characteristics:

- 1. They are unicellular.*
- 2. Cell wall is made of murine.*
- 3. They lack true nucleus.*
- 4. They lack membrane bounded organelle.*
- 5. They are microscopic.*
- 6. They have small size ribosome (70s).*
- 7. They may be autotrophic or may be a heterotrophic.*
- 8. They are divided by binary fission e.g. bacteria and cyanobacteria.*

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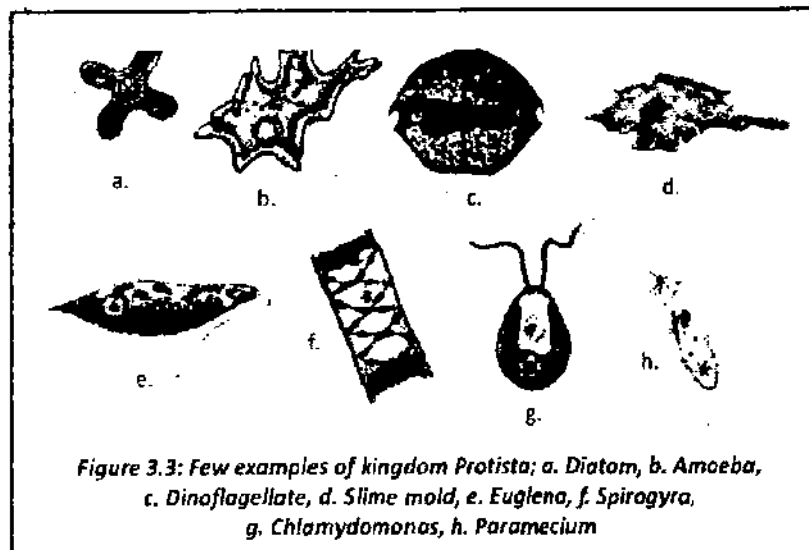


(ii) Kingdom Protista:

Also called trash can kingdom because it include plants, animals and fungi like organism.

Characteristics:

1. They are simple eukaryotes.
2. They may be autotrophic or may be heterotrophic.



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3. They may be unicellular or multi-cellular.
4. They are complex then prokaryotes.
5. They lack cell wall.
6. They also make colonies.
e.g. plasmodium, amoeba and euglena etc.

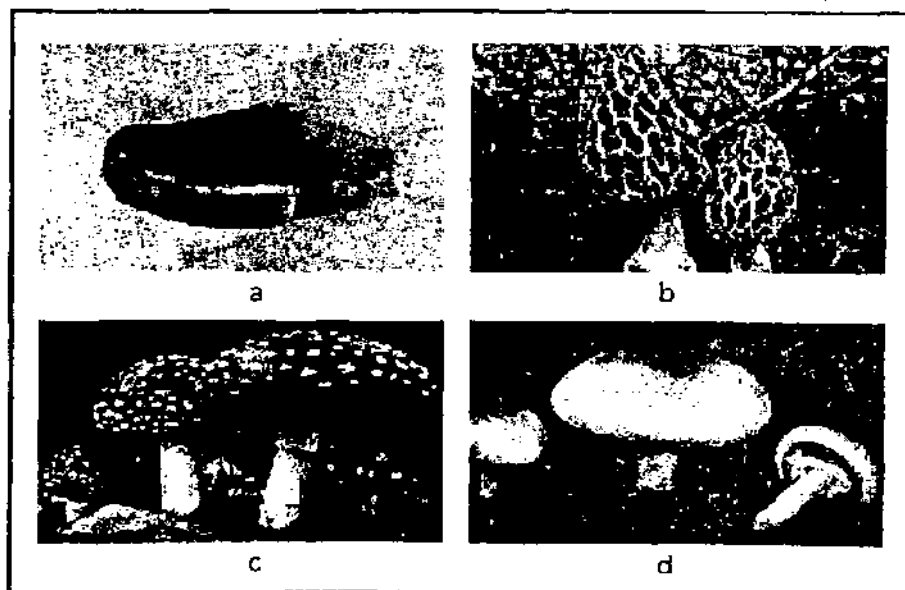
(iii) Kingdom Fungi: (BISE Malakand 2015)

Characteristics:

1. They are eukaryotes.
2. They may be unicellular (yeast) or may be multi-cellular (mushroom).
3. They are non-motile.
4. They may produce spores.
5. They are heterotrophic.
6. Their cell wall is composed of chitin.

Mycelium: The body of fungi is called mycelium. It is made of hyphae.

Examples: Yeast, mushroom, rust and smut etc.



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(iv) Kingdom Plantae:

Characteristics:

1. They are all eukaryotes.
2. They are multi-cellular
3. They possess chlorophyll.
4. They are autotrophic
5. Their cell wall is composed of cellulose.
6. They are non-motile.
7. They produce spores.
8. They have no centrioles.

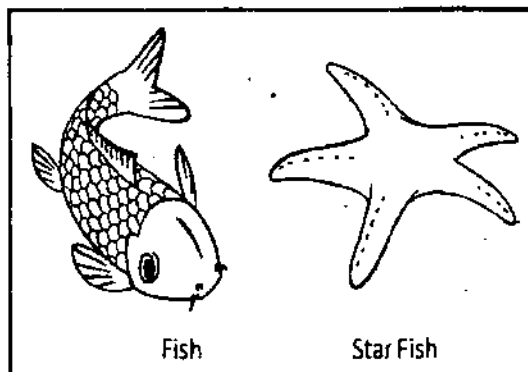


Examples: Rose, conifers, ferns, wheat and sugar cane etc.

(v) Kingdom Animalia:

Characteristics:

1. They are eukaryotes.
2. They are multi-cellular.
3. They develop from haploid cells.
4. They are diploid.
5. They have no



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chlorophyll.

- 6. They are heterotrophic.
- 7. They lack cell wall.
- 8. They are motile.
- 9. They reproduce both asexually and sexually.

Examples: Vertebrates and invertebrates.

Q9: Compare the two kingdoms and five kingdom system of classification.

Ans: Comparison of two kingdoms and five system of classification:

Two Kingdoms System	Five Kingdoms System
1. It was proposed by Carolus Linnaeus.	It was proposed by Robert Whittaker.
2. Organisms are classified into two groups.	Organisms are classified into five groups.
3. It is based on nutrition and motility.	It is based on structure of cell, complexity, mode of nutrition and evolution.
4. It is questionable because they place euglena, bacteria and fungi in kingdom plantae.	In this organism are placed correctly in each kingdom.

**Q10: Write a note on virus.
(BISE Abbottabad 2018)**

Ans: Virus:

The word "virus" is derived from Latin word "ve-

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nom" which means poisonous fluid.

Definition:

Virus is Acellular obligate parasite surrounded by proteins. Obligate parasite means that it can live only inside the body of living organisms.

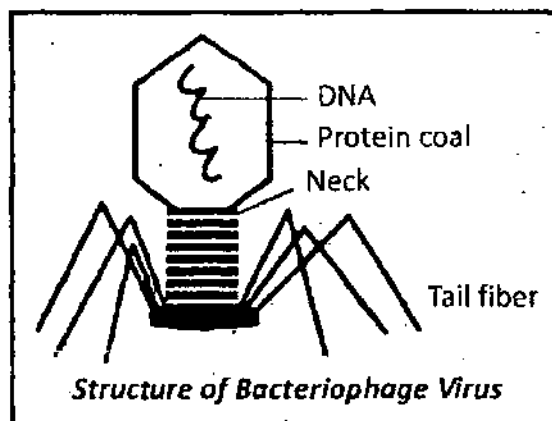
Q11: Discuss status of virus.

Ans. Virus is excluded from five kingdom system of classification because it cannot match the properties of any organism. Virus posses both living and non-living properties.

Living Properties	Non-Living Properties
1. They have nucleic acid i.e. DNA or RNA.	They do not have cell.
2. They can reproduce.	They do not respire.
3. They cause diseases.	They do not excrete.
4. Mutation can occur.	It can be crystallized.

Conclusion:

From the above explanation we concluded that virus is on the border line between living and non-living organism.



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Q12: What is binomial nomenclature? Also write its importance. (BISE Malakand 2016)

Ans. Binomial Nomenclature: (Bi-two, nomen-name, clare-to call)

A system of nomenclature in which each specie of organism receives the name of two terms i.e. one generic name and one specific name. This system of nomenclature was introduced by Carolus Linnaeus.

Rules for Binomial Nomenclature:

1. It must contain two terms.
2. The first letter of the generic name is written capital while the first letter of specific name will be written in small.
3. It should be italicized when type or underline when write on paper or board.
4. There is no punctuation between two names.
5. Specific name should be written after generic name. e.g. homo sapiens, brassica comprestic.

Importance of Binomial Nomenclature:

1. Scientific name are more definite and precise as compare to local names.
2. They have universal acceptance because they are written in Latin.
3. They show generic relationship of various organisms.
4. They are easier to study the description of animals.

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Q13: What is meant by conservation of biodiversity? Discuss impact of human on biodiversity.

Ans. Conservation:

Conservation means to use the natural resources such as plants, animals, minerals and water in a sensible way.

Conservation of Biodiversity:

Conservation of biodiversity means to utilize different living organisms under judicial way. It is done to fulfill the needs of present generation as well as for the future generation.

Impact of Human Being on Biodiversity:

The biodiversity of an area is mostly affected by the activities of human being. Human destroy the biodiversity of an area by the following ways:

1) Habitat Loss:

Human utilizes land and natural resources and destroying the valuable habitat of wild life. So the wild organisms are decreasing in number day by day.

2) Deforestation:

1. Deforestation means removal of forests.
 2. People clearing forests in order to get food, wood and developing land for agriculture and homes.
 3. In Pakistan forest covers only 5.2% of the land.
 4. In Pakistan the forest area is shrinking very fast.
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5. According to report of WWF since 1947 more than 151,500 area of forest land have been converted into non-forest land.

3) Over Hunting:

1. Over hunting of animals also cause loss of bio-diversity.
2. In Pakistan various lizards, snakes, crocodiles and large mammals are hunted for various purposes.
3. A large number of migratory birds passing through Chitral are hunted and killing during their migration.

4) Introduction or Removal of a Specie:

The Introduction of new species to an ecosystem may prove harmful effect for the species of an area. e.g. eucalyptus trees were imported to Pakistan from Australia. These trees consume more water and disturbed the level of ground water. Hence other small plants cannot grow near these trees.

Removal of a Specie:

Removal of a specie from an ecosystem also effect other species. e.g. starfish eat mussels which are harmful to many other species. If starfish is removed from ecosystem the mussels will increase in number and so they will be harmful for other species.

5) Rapid Industrialization:

The industries release chemical pollutants which are harmful for a specie.

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Q14: What is deforestation? Write its causes and effects.

Ans. Deforestation:

Deforestation means removal of forests. The destruction or removal of forest in an unwise and unplanned manner is called deforestation.

Importance of Forests:

1. They provide habitat for wild life.
2. They give us oxygen.
3. They clean our atmosphere by taking CO_2 .
4. They give us food.
5. They are the source of fuel and timber.
6. They control flood.
7. They prevent soil erosion.

Causes of Deforestation:

1. Forests are cut to built roads and houses.
2. Trees are cut to get wood for fuel and furniture.
3. They are cut to make land for cultivation.
4. Trees are also removed to develop pastures for grazing.
5. Timber mafia cut trees for easy cash.

Effects of Deforestation:

1. Deforestation leads to soil erosion.
2. Destruction of habitat of wild life.
3. It also leads to desertification.
4. Due to deforestation extinction of many species of organisms occurs.
5. It leads to oxygen deficiency.
6. It also leads to flooding.

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Q15: What is endangered species? List endangered species of Pakistan.

Ans. Endangered Species:

"The specie which are in the danger of extinction are called endangered species"

Endangered Species in Pakistan in Animals:

In Pakistan 37 species of mammals, 20 species of birds and five species of reptiles are listed as endangered e.g. the birds houbara bustard (talor) and capra falconeri (markhor) and plant like yew, chilg-hoze, and sanobar have endangered in Pakistan.

Q16: Define extinct and threaten specie.

Ans. Extinct Specie:

"The specie that no longer lives anywhere on the earth is called extinct specie." e.g. in Pakistan animal like Asiatic cheetah, tiger lion, Indian wild ass, swamp deer and hangul etc have become extinct.

Threaten Species:

"The specie which are likely to become extinct is called threaten specie."

Q17: What are the issues of conservation of biodiversity in Pakistan?

Ans. Issues of Conservation of Biodiversity in Pakistan:

1) Deforestation:

Deforestation results in the removal of natural of the area. in Pakistan we have only 5.2% forests.

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Removal of these forests destroyed the habitat of wild life.

2) Over Hunting:

1. *Due to over hunting macropolo sheep and markhor has been reduced.*
2. *Musk deer are killed for their gland used for making perfume.*
3. *Similarly over fishing leads to the extinction of many species in rivers.*

Steps taken in Pakistan to conserve Biodiversity:

Following are few steps taken in Pakistan to conserve biodiversity:

1. *Indus dolphin project to conserve Indus dolphin.*
2. *Protected areas of management project in Machiara in Azad Jamu Kashmir.*
3. *Marine turtle conservation project.*
4. *Ban on hunting of markhor and urial in Baluchistan.*
5. *Himalaya jungle project.*
6. *Conservation of biodiversity of the Suleman Range, Baluchistan.*
7. *Northern area conversation project.*
8. *Conservation of migratory birds in Chitral KPK.*
9. *Himalaya wild life project to check the hunting of brown bears.*
10. *Conservation of Chiltan markhor.*
11. *Ban on bear-baiting in Pakistan.*

EXERCISE

A. Encircle the best suitable answers.

1. Which character of viruses makes their resemblance with living organisms?
(a) They can be crystallized
(b) They cannot live outside host body
✓ (c) They contain DNA or RNA
(d) All of the above
2. Euglena belongs to the kingdom Protista because:
(a) It is Unicellular ✓ (b) It is Eukaryotic
(c) Having both plant and animal like characters
(d) It lives in water
3. The correct sequence of hierarchy from small to large units is:
✓ (a) Genus → family → order → class
(b) Family → order → class → genus
(c) Genus → family → class → order
(d) Species → family → genus → class
4. The kingdom which contains eukaryotic, autotrophic organisms is:
(a) Protista (b) Monera
(c) Fungi ✓ (d) None of them
5. The five kingdom system of classification was modified by:
✓ (a) Robert Whittaker
(b) Margulis and Schwartz
(c) Carolus Linnaeus (d) Aristotle
6. Aristotle classified organisms on the basis of:

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- ✓ (a) Habitats (b) Cell structure
(c) Morphology (d) Anatomy
7. Which of the following kingdoms possesses the simplest organism?
(a) Fungi ✓ (b) Monera
(c) Protista (d) Plantae
8. What is binomial nomenclature?
(a) Classifying organisms on seven levels
(b) Naming system developed by Aristotle
(c) Grouping animals based on their habitat
✓ (d) Naming system in which each organism is given a two- part name
9. Which one may be the correct way of writing scientific name of an organism?
(a) *Canis lupus* (b) *Saccharum*
(c) *Gaint's gazelle* ✓ (d) *Escherichia coli*
10. Which kingdom includes organisms with cell wall but without chlorophyll?
(a) Protista ✓ (b) Fungi
(c) Plantae (d) Animalia
11. Which one is the basic unit of classification?
(a) Genus ✓ (b) Species
(c) Family (d) Order
12. Maximum biodiversity is found in:
✓ (a) Forests (b) Grasslands
(c) Deserts (d) Mountains

Short Questions

B. Write short answers for the following questions:

Q1: How does deforestation lead to desertification?

Ans: Desertification:

"The process of formation of deserts is called desertification." Desertification occurs due to the following reasons:

1. When we cut forests or trees the total amount of water in the soil decrease so it leads to desertification.
2. Deforestation leads to decrease in humidity in air.
3. Deforestation results in shortage of rain water which causes desertification.

Q2: Why is it important for biologist to understand biological classification?

Ans: Biological Classification:

The arrangement of organisms into groups and sub-groups on the basis of their similarities and differences is called biological classification.

Importance of Biological Classification to Biologist:

1. To understand the great variety of organisms.
2. To know similarities and differences between organisms.
3. To know the generic relationship between organisms.
4. To know the number of specie and name of organisms.

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Q3: What is the status of virus in classification? (BISE Abbottabad 2015)

Ans. Virus possesses both living as well as non-living properties, so it is placed on the border line between living and non-living organisms. It is excluded from five kingdom classification because its properties cannot match with any member of five kingdom classification.

Q4: How you can differentiate between kingdom Monera and Protista?

Ans.

Kingdom Monera	Kingdom Protista
1. They have prokaryotic cell.	They have eukaryotic cell.
2. They have no well developed nucleus.	They have well developed nucleus.
3. Membrane bounded organelles are absent.	Membrane bounded organelles are present.
4. They are simplest.	They are complex.
5. All members are unicellular.	They may be unicellular or may be multi-cellular.
6. Cell wall is present.	Cell wall is absent.

Q5: List down the endangered species of Pakistan and what are the reasons behind their population decrease.

Ans. Endangered Species of Pakistan:

1. Mammals: 31 species e.g. markhor
2. Birds: 20 species e.g. haubara bustard.

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- 3. *Reptiles: 5 species*
- 4. *Plants like yew, chilghoza and sanobar have become endangered in Pakistan.*

Reasons of Endangered Species in Pakistan:

- 1. *Over hunting*
- 2. *Deforestation*
- 3. *Rapid industrialization*
- 4. *Over population*
- 5. *Climate changes*
- 6. *Habitat destruction*

Long Questions

C. Write detailed answers for the following questions:

Q1: Differentiate between two kingdom system and five kingdom system along with their advantage and disadvantages.

Ans. Please see Question number 9.

Q2: Take one organism and assign it to different ranks according to hierarchy of taxonomy.

Ans. Classification of human into different ranks of taxonomy:

Kingdom	-	Animalia
Phylum	-	Chordata
Class	-	Mammalia
Order	-	Primata
Family	-	Homonidae
Genus	-	Homo
Specie	-	Sapien

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Q3: How human activities affect the biodiversity of an area?

Ans- Please see Question number 13.

Q4: Explain binomial Nomenclature. What are its advantages?

Ans- Please see Question number

Q5: What are the reasons for the for extinction? World wide and what measures are required to conserve the biodiversity of Pakistan?

Ans- Reasons for the Extinct of Biodiversity:

1. Deforestation
2. Over.hunting
3. Environmental pollution
4. Slow breeding
5. Food deficiency
6. Removal of some species
7. Introduction of new species
8. Over population

Measure to Conserve Biodiversity in Pakistan:

1. Awareness of people through social media to converse biodiversity.
 2. Over population should be controlled.
 3. Avoid over grazing
 4. Avoid over hunting
 5. Stop deforestation
 6. Extensive programs of forestation are required.
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CHAPTER

4

CELL & TISSUE

Q1: Define cell. What is unicellular and multi-cellular organism? خلیہ کیا ہے؟

Ans. Cell:

Cell is derived from a Latin word "cellula" which means small room. Cell is a unit surrounded by membrane. It is the basic structural and functional unit of life.

Unicellular Organisms: (uni-one, cellular-cell)

"Those organisms which contain only one cell are called unicellular organisms." e.g. bacteria and amoeba etc.

Multi-cellular Organisms: (multi-many, cellular-cell)

"Those organisms which are composed of many cells are called multi-cellular." e.g. human and mustard.

Q2: What is microscope? Define microscopy.

Ans. Microscope: (micro-small, scope-to look)

A device by the help we can see those objects that are too small to naked eyes.

Microscopy:

"The use of microscope the study cell and its components is called microscopy."

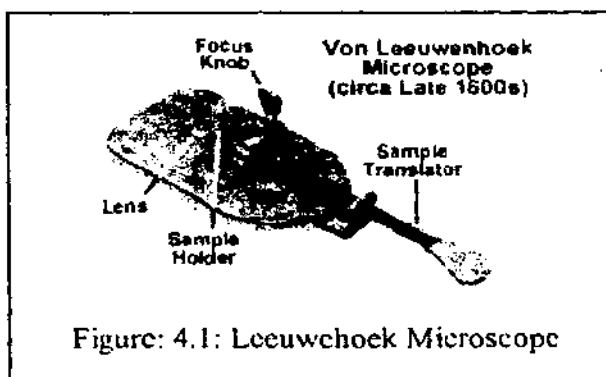
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Development of Microscope:

1. The first microscope was developed by Zacharias Janseen in Holland in 1695.
2. It was simply a tube with lenses at each end.
3. Its magnification power is 3x to 9x.

Antonie Van Leeuwenhoek:

Leeuwenhoek was a Dutch scientist made a much better microscope to observe small organisms. Its magnification power is 250x. He is considered to be the 1st microscopist.



Q3: Define magnification and resolution.

Ans: Magnification:

"The ability of microscope to enlarge the actual size of an object is called magnification." It is expressed in units abbreviated as x e.g. 10x, 20x etc.

Resolution:

"The ability of microscope to separate the two close

objects is called resolution." Resolving power of human eye = 0.7mm.

For Your Information:

Magnification power of light microscope = 1500x.

Electron microscope = 250,000x

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Q4: What are the different types of microscope?

Ans- 1) Simple Microscope:

The microscope which does not need electricity to illuminate object. It contains one lens.

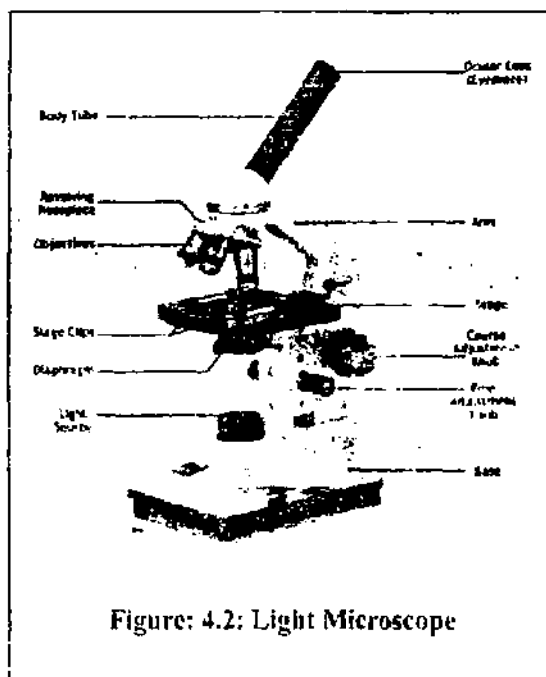
2) Light Microscope:

"The microscope which needs electricity to illuminate object is called light microscope."

1. It contains two lenses.
2. Its magnification power is $= 1500\times$.
3. Its resolving power is $0.2\mu m$.

Mechanism of Image Formation on Light Microscope:

1. Light passes through the sample and then through two glasses lenses.
2. The first lens produce enlarge image while the second lens magnifies this image more.
3. The light after passing the object and lens it is projected into viewer's eye where an enlarge and clear image is formed.



3) Electron Microscope:

This microscope uses beam of electron instead of

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light. In this magnetic lens focus the electron beam on a screen or photographic film and make much enlarge image. Its resolving power is 0.2nm .

Types of Electron Microscope:

There are two types of electron microscope:

(i) Transmission Electron Microscope (TEM):

This microscope is used to study the cell internally. Its magnification power is 250,000.

(ii) Scanning Electron Microscope (SEM):

This microscope is used to study the surface of a cell. The surface of a cell is coated with metal. When electron beam hits this metal it is reflected and makes the enlarge image.

Q5: Compare between light and electron microscope.

Ans:

	Light microscope	Electron Microscope
Radiation Type	Light	Beams of electrons
Lenses	Optical	Magnetic
Magnification	10,000 time greater than naked eye	100 time greater than light microscope
Resolution	500 times of the naked eye	400 times of light microscope
Image	2D image	3D image

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Q6: Discuss history of emergence of cell theory.

Ans: History of Emergence of Cell Theory:

Various scientists play role in the formulation of cell theory. Some are given below:

1) Robert Hook:

1. He was an English microscopist.
2. He was the first person that observes a cell under microscope.
3. He studied a thin slice of cork which is made of wood under his self designed microscope.
4. In this he saw small chambers which are given the name cellula.

2) Antonie Van Leeuwenhoek:

1. He was a Dutch scientist.
2. He made much powerful microscope.
3. Through his microscope he study a drop of water and saw tiny unicellular creature in it.
4. He called these creatures as "animalcules" swimming around.

3) Jean Baptiste De Lamarck:

1. He was a French scientist.
2. He also observed cell when he examined the pair of animals and plants under microscope.
3. He concluded that all living organisms are made of cellular tissues.

4) Robert Brown:

1. He was a British botanist.
2. He describes nucleus in a cell and made a new concept that the center of cell is not empty.

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5) Mathias Schleiden:

He was a German botanist. He claimed that all plants are made of cells.

6) Theodor Schwann:

He was German zoologist. He claimed that all animals are made of cells.

7) Jan Evangelista Purkinji:

He was a Czech scientist. He discovered the fluid substance in a cell and called it protoplasm.

8) Rudolf Virchow:

1. He was a German pathologist.
2. He stated that every cell arises from pre-existing cell.

9) Louis Pasteur:

1. He was a French scientist.
2. He proved experimentally the idea of Virchow.
3. He demonstrated that bacteria could be formed only from pre-existing bacteria.

**Q7: What are the main points of cell theory?
(BISE Abbotabad 2014, Malakand 2016)**

Ans. Cell theory was formulated by Theodor Schwann and Matthias Schleiden in 1838.

Main Points:

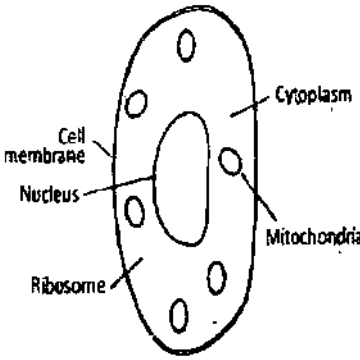
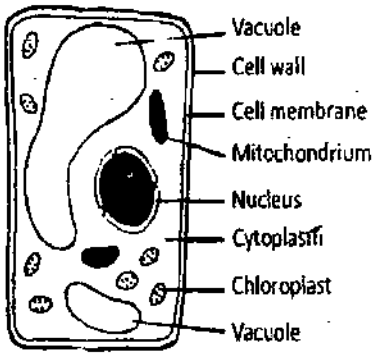
1. All organisms are made of cells i.e. unicellular and multi-cellular.
 2. Cell is the basic structural and functional unit of life.
 3. New cells arise from pre-existing cells by cell division.
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4. Cell contains genetic information which are transfer to next generation.

Q8: Differentiate between animal and plant cell.

Ans:

Animal Cell	Plant Cell
1. It is comparatively small.	It is large.
2. Cell wall is absent.	Cell wall is present.
3. Nucleus occurs in center	Nucleus occurs at one side.
4. They have more numbers of mitochondria.	They have less numbers of mitochondria.
5. Chloroplast is absent.	Chloroplast is present.
6. They have many small vacuoles.	They have one large vacuole.
 <p>Animal Cell</p>	 <p>Plant Cell</p>

Q8: What is cell wall? Write its functions.

Ans: Cell Wall:

1. It is the outermost wall of plant cell. Its thickness is change from cell to cell.
2. It is absent in animal cell.
3. It is also present in bacteria and fungi.

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Chemical Composition:

1. In Plant cell it is composed of cellulose.
2. In fungi it made of chitin.
3. In bacteria it is made of murine.

Components of Cell Wall:

Cell wall is composed of three layers:

1) Primary Wall:

It is the first wall which is composed of mainly cellulose.

2) Secondary Wall:

It is formed on the inner side of primary wall. It is tough and strong. It is composed of cellulose, hemicelluloses and lignin.

3) Middle Lamella:

It is a layer which is found between two cells. It is composed of calcium and pectin.

Functions:

1. It provides shape to the cell.
2. It gives support to the cell.
3. It is a permeable membrane for diffusion and helps in the absorption of minerals and solutes along with water.

Q10: Write a note on structure and function of cell membrane. (BISE Mardan 2016, Swat 2017)

Ans: Cell Membrane:

1. It is the outermost boundary of animal cell.

Other names of plasma membrane:

1. Cell membrane
2. Plasmallema
3. Cytoplasmic membrane

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2. In plant cell it lies next to cell wall.

3. It is thin and elastic.

Chemical Composition:

Chemically it is composed of:

1. Proteins (60-80%)

2. Carbohydrates (2-10%)

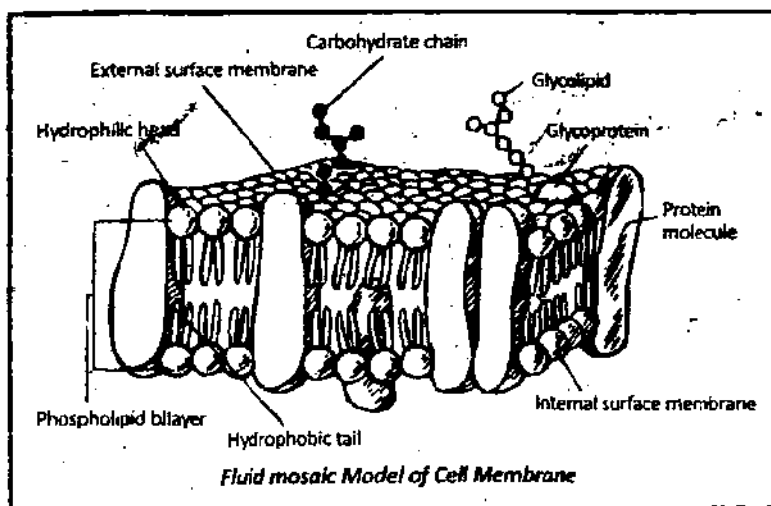
3. Lipids (20-40%)

Structure of Cell Membrane:

There are various models about the structure of cell membrane but the most accepted model is fluid mosaic model.

Fluid Mosaic Model:

This model was proposed by Singer and Nicolson in 1972.



Statement:

"Cell membrane is composed of two layers of lipids called lipid bilayer." In these two layers some proteins are floats while some are embedded or fix in the membrane of lipids. Some carbohydrates molecules are attached to protein forming glycoproteins.

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Functions:

1. It protects the inner content of a cell.
2. It gives strength to the cell.
3. It provides mechanical support to the cell.
4. It excretes wastes products from cell.
5. It also secretes useful substance from cell such as enzyme and hormones.
6. It is being semi-permeable so allow some material to pass through it.

Q11: Explain cytoplasm.

Ans. Cytoplasm:

"The space or region between cell membrane and nucleus is called cytoplasm." It is colourless and concentrated fluid. It is elastic.

Composition:

1. It is mostly contain of water (90%).
2. It also contains organic and inorganic substances.

Parts of Cytoplasm:

It is composed of two parts:

1. Cytosol
2. Insoluble part

1) Cytosol:

1. It is the soluble part of cytoplasm.
2. It is aqueous and dissolve a great variety of substances.
3. It contains soluble protein and vitamins.

2) Insoluble Part:

It is insoluble part which contains cytoplasmic structures such as mitochondria, endoplasmic reticulum and ribosome etc.

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Functions:

1. It is a store house for various organelles.
2. It is a site for various biochemical reactions.
3. It contains cytoskeleton that provides support to the cell.

Q12: Discuss endoplasmic reticulum.

Ans: Endoplasmic Reticulum:

Endo-inside, plasmic-cytoplasm, reticulum-network

It is a network of flattened membrane extended throughout the cytoplasm. It forms a connection between cytoplasm and nucleus.

Discovery:

It was discovered by Porter in 1953.

Types:

Endoplasmic reticulum are of two types:

1) Smooth Endoplasmic Reticulum (SER):

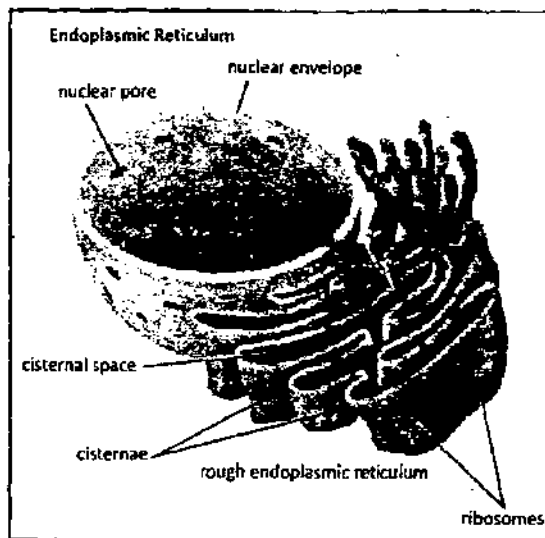
It is non-granular due to the absence of ribosome on its surface.

2) Rough Endoplasmic Reticulum (RER):

It is rough or lar due to the attachment of ribosome to its surface.

Functions:

1. It exchanges materials between



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lasm and nucleus.

2. It provides a platform for the attachment of ribosome.
3. RER helps in protein synthesis.
4. SER helps in lipids metabolism.
5. SER helps in detoxification of drugs.
6. SER helps in synthesis of vitamin D.

Q13: Write a note on structure of Golgi bodies.

Ans. Golgi Bodies:

It is a double membrane bound structure present in the cytoplasm of eukaryotic cells. It contains stacks of flattened sac called cisternae.

Discovery:

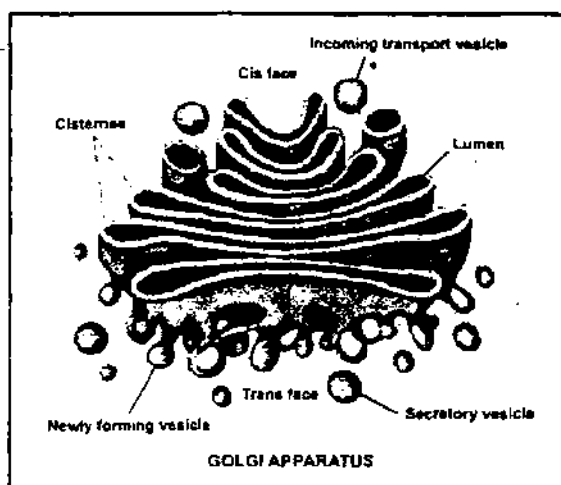
It was discovered by an Italian neurologist Camillo Golgi in nerve cell in 1998.

Structure of Golgi Bodies:

1. It contains flattened stacks which grouped together forming cisternae.
2. These cisternae are dilated at margins.
3. It also contains rounded sacs called golgi vesicles.
4. These vesicles contain zymes and inorganic salts.

Functions:

1. It stores



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cretions and convert them into final product (form).

2. It is involved in packaging of materials.
3. It helps in the formation of new plasma membrane.
4. From plant cell it secretes waxes, gums and mucilage.

**Q14: Write a note on mitochondria.
(BISE Abbottabad 2018)**

Ans. Mitochondria: (Mito-thread, condrion-small grain)

These are granular bodies found in the cytoplasm of eukaryotic cell. It is surrounded by double membrane.

Discovery:

It was discovered by Kooliker in 1850 in skeletal muscle. Its number is different from cell to cell in animals.

Components:

It is composed of three components:

1. Outer membrane
2. Inner membrane
3. Matrix

1) Outer Membrane:

It is smooth and made of lipids and proteins.

2) Inner Membrane:

This membrane is folded inward forming cristae.

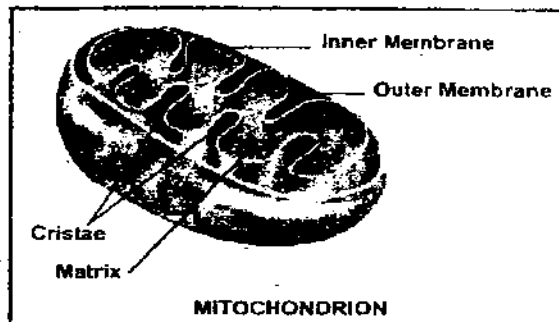
3) Matrix:

It is inner dense portion of mitochondria. It contains various enzymes.

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Functions:

1. It is involved in cellular respiration. So release energy from food.
2. It is also called power house of the cell because it releases energy (ATP).



Q15: What is ribosome?

Ans. Ribosome:

These are small, dense, rounded and granular particles occur in a cell. They may occur free in cytoplasm or attached with endoplasmic reticulum.

Discovery:

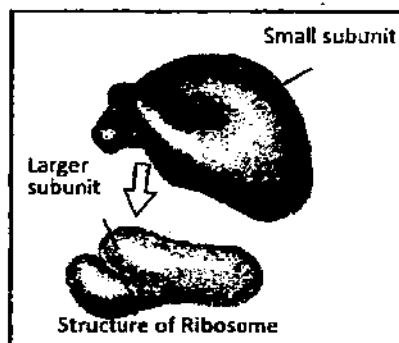
It was discovered by Palade in 1955.

Chemical Composition:

It is composed of proteins and ribosomal RNA.

Structure of Ribosome:

1. Each ribosome is composed of two small units.
 - Small sub unit
 - Large sub unit
2. Small sub unit is small in size and occurs above large sub unit.
3. The two sub units are joins together by high concentration of Mg^{++} .



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Types of Ribosome:

There are two types of ribosome:

1. 70s: It is found in bacteria.
2. 80s: It is found in eukaryotic cell.

Function:

Protein synthesis

**Q16: Write a note on plastids.
(BISE Abbottabad 2014)**

Ans. Plastids:

1. It is membrane bounded organelle present only in plant cells.
2. They contain special pigments.
3. They are spherical like in shape.

Types of Plastids:

On the basis of functions and pigments there are three types of plastids:

1. Chloroplast
2. Chromoplast
3. Leucoplast

1) Chloroplast: (Chloro-chlorophyll, plast-plastid)

1. These are green plastids.
2. It contains green pigment called chlorophyll.
3. It is the most abundant and important plastids.

Structure of Chloroplast:

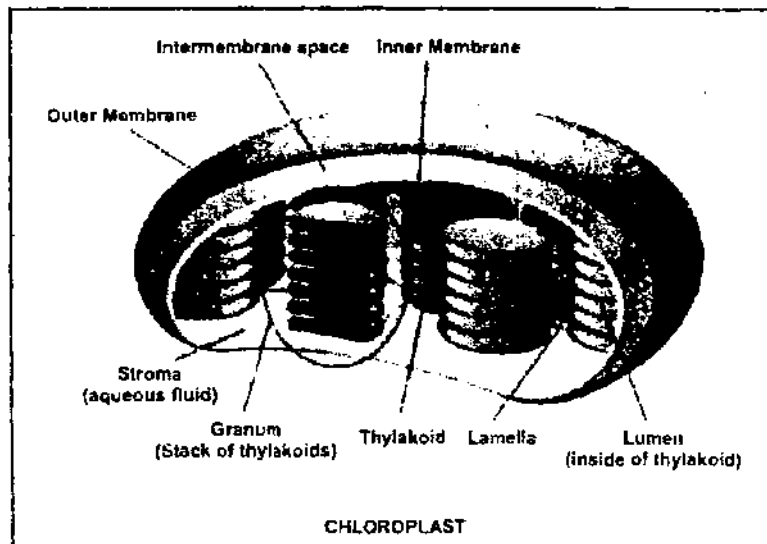
It consists of three main components:

1. Envelope
2. Grana
3. Stroma

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(i) Envelope: It is the outer double layer covering of chloroplast. It enclosed the grana and stroma.



(ii) Grana: It contains many flattened fluid filled membrane called thylakoid. These thylakoid are grouped together forming a granum.

(iii) Stroma: It is the central space inside the envelope. It contains various enzymes and ribosomes.

2) Chromoplast: (Chromo-colour, plast-plastid)

1. These are colours other than green.
2. They may be red, yellow, pink and blue etc.
3. They are mostly found in flowers and fruits.
4. Due to its bright colour it attracts insects for pollination.

3) Leucoplast: (Leuco-white, plast-plastid)

These are colourless plastids. It is mostly found in food storage part of plant i.e. roots.

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Functions of Plastids:

1. Chloroplast helps in photosynthesis.
2. Chromoplast acts to attracts insects for pollination.
3. Leucoplast acts to store food for plants.

Q17: Discuss cytoskeleton. (BISE Kohat 2017)

Ans. Cytoskeleton:

It is a network of protein filament extended throughout the cytoplasm.

Types

1. Microtubule
2. Macro filament
3. Intermediate filament

1) Microfilament:

It is small rod like structure extended in cytoplasm.
It occurs in the form of bundles.

Functions:

1. It plays role in muscle contraction.
2. They give support and strength to the cell.

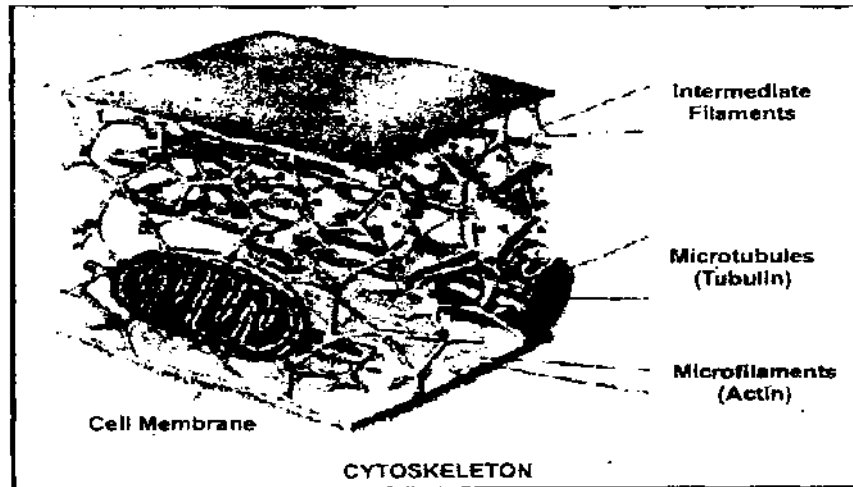
2) Microtubule:

It is a microscopic tubular structure present in the cytoplasm. It is made of globular protein.

Functions:

1. It forms spindles fiber of the dividing cell.
 2. It is involved in the formation of centrioles, cilia and flagella.
 3. It provides support and strength to the cell.
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3) Intermediate Filament:

These are intermediate between microtubule and microfilament.

Functions:

1. *It provides mechanical support to the cell.*
2. *It maintains shape of the cell.*

Q18: What is centriole?

Ans. Centriole:

*It is a cylindrical organelle present near the nucleus.
It occurs in pair form.*

Size:

It is about 0.3 - 0.5 μ m in length and 0.2 μ m in diameter.

Structure:

Under electron microscope the cross section of centriole is:

1. *It contains nine sets of microtubule.*
2. *Each set of microtubule is composed of three microtubules.*

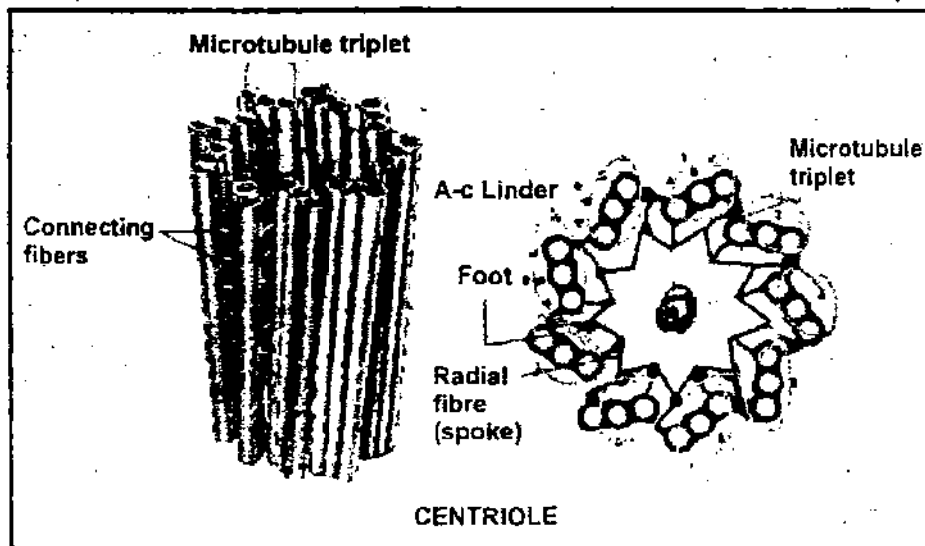
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3. Total number of microtubule in one centriole is 27.

Functions:

1. It is involved in cell division.
2. It also helps in the formation of cilia and flagella.



Q19: Discuss vacuole.

Ans: Vacuole:

It is a fluid filled single membranous sac present in eukaryotic cell. The membrane of vacuole is called tonoplast.

Explanation:

1. Animal cell contains many small vacuoles.
2. Plant cell contains one large vacuole.
3. There are two types of vacuole:
 - a. Food vacuole
 - b. Contractile vacuole

Composition of Vacuole:

The fluid of vacuole contains water, salts, amino

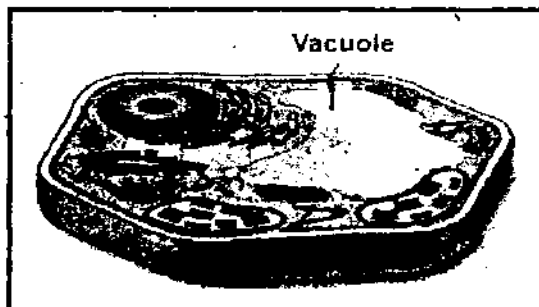
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acids, vitamins, pigments and other materials.

Functions:

1. Food vacuole helps in intake and storage of food.
2. Contractile vacuole removes wastes from the cell.
3. It increases the size of cell by absorbing water.



Q20: What is lysosome.

Ans. Lysosome: (Lyso-splitting, soma-body)

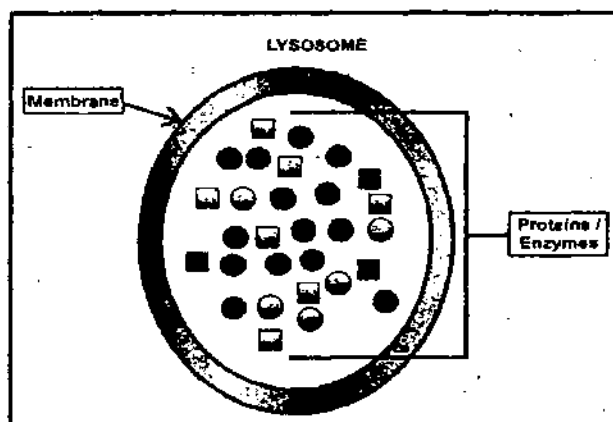
It is a single membrane bounded organelle present in eukaryotic cell.

Discovery:

It was discovered by C. de Duve in 1955.

Occurrence:

It occurs in most animal cells and in few plants.



Chemical Composition:

It is composed of many enzymes such as proteases, nucleases, lipases and phospholipase.

Functions:

1. It helps in digestion of food.

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2. It eats microorganisms that enter the cell.
3. It also play role in development process.

Q21: Write the structure and function of nucleus.

Ans. Nucleus:

It is the most important and prominent body of eukaryotic cell.

Discovery:

It was discovered by Robert Brown in 1838.

Components of Nucleus:

It is composed of four components:

1. Nuclear membrane
2. Nucleoplasm
3. Nucleolus
4. Chromosome

1) Nuclear Envelope:

It is a double membrane structure surrounded by nucleus. It separates nuclear material from cytoplasm.

2) Nucleoplasm:

It is a semi liquid matrix in nucleus. It contains enzymes, proteins and minerals.

3) Nucleoli:

It is a spherical structure inside the nucleus. They may be one or two in number. It forms ribosome.

4) Chromosome: (Chroma-colour, soma-body)

1. These are thread like structure present inside the nucleus.
 2. It is the main structure inside the cell.
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3. It was discovered by Waldeyer in 1876.
4. Chromosome is more visible during metaphase phase of cell division.

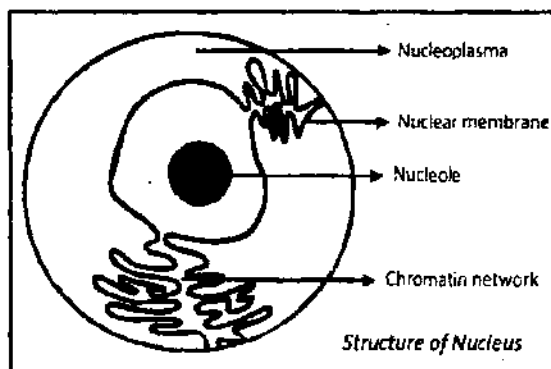
Composition:

Chromosome is composed of proteins (55%) and DNA (45%).

Number of Chromosomes:

Every specie have different numbers of chromosomes.

- Human: 46
- Frog: 26
- Radish: 18
- Onion: 16



Functions:

1. It is the cell control room of the cell.
2. It helps in cell division.
3. It transfers the characters from parents to offspring.
4. It also synthesizes ribosome.

Q22: Differentiate between prokaryotic and eukaryotic cell.

Ans:

Prokaryotic Cell	Eukaryotic Cell
Pro-before, karyon-nucleus	Eu-true, karyon-nucleus
1. True nucleus is absent.	True nucleus is present.
2. Membrane bounded organelle is absent.	Membrane bounded organelle is present.

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3. Chromosome is dispersed in cytoplasm.	Chromosome is present in nucleus.
4. They have small size ribosome: 70s	They have large size ribosome: 80s
5. Cell wall is made of murine.	Cell wall is made of cellulose (plants) or chitin (bacteria)
6. It is simple.	It is complex.
7. They are comparatively small in size. Example: Bacteria	They are comparatively larger in size. Example: Protista, plant, fungi and animals

Q23: Explain cell and their specificity.

Ans. Cell and their Specificity:

It means that in multicellular organisms every cell of the body is specific to its function. But in unicellular organisms its one cell performs all the activities of life.

Examples in Plants:

1. In plant cell xylem is specialized to conduct water.
2. Phloem is specialized to transport food materials.
3. Similarly there are cells which are specialized for photosynthesis.

Examples in Animals:

1. In animal's nerve cell are specific to carry nerve impulse.
2. Muscle cells undergo contraction and relaxation hence play role in body movement.
3. Red blood cells (RBC) transport oxygen.
4. WBC kills pathogens.

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Every Cell is Specialized for its Function:

1. e.g. nerve cells are long for the transmission of nerve impulse.
2. RBCs are disc like and biconcave in shape so increase the surface area to volume ratio for binding and transporting oxygen.
3. Root hair cell have large surface area to absorb more water.
4. Cells that are involved in making secretion have complex endoplasmic reticulum and golgi bodies.
5. Cell that performs photosynthesis have chloroplast.

Q24: How cell is an open system?

Ans. Cell is an open system because it takes substance in from surrounding needed for its activities.

1. These substances are taking in through cell membrane.
2. Then it performs metabolic process assigned to it.
3. After metabolism products and by-products are formed.
4. These products are either utilizes the cell by itself or transfer to other cell.
5. The by-products are expelled out from the cell.

Q25: Discuss surface area to volume ratio.

Ans. Surface area is the external surface of a cell which is exposed to outer environment.

Explanation:

As a rule large cells have less surface area in relation to their volume while small cell have more surface area. For example;

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1. We have two cells that is larger cell A and small cell B.
2. Cell A have larger surface area than cell B.
3. In figure shows one larger cell and 27 small cells.
4. In both cases the total volume is same i.e.
 $\text{Volume} = 30\mu\text{m} \times 30\mu\text{m} \times 30\mu\text{m} = 27000\mu\text{m}^3$
5. In contrast to the total volume, the total surface area are very different because the cell have 6 sides, its surface area is 6 times the area of one side.

The surfaces of these cells are as follow:

1. Surface area of one large cell
 $= 6 \times (30\mu\text{m} \times 30\mu\text{m}) = 5400\mu\text{m}^2$
2. Surface area of one small cell
 $= 6 \times (10\mu\text{m} \times 10\mu\text{m}) = 600\mu\text{m}^2$
3. Surface area of 27 small cells:
 $= 27 \times 600\mu\text{m}^2 = 16,200\mu\text{m}^2$

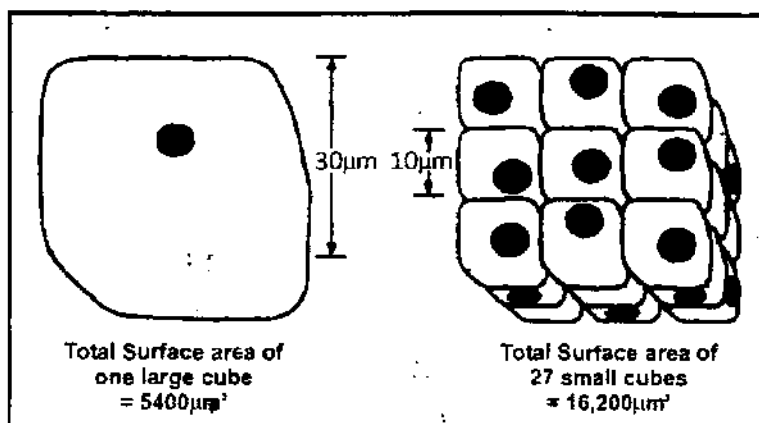
Volume:

"The space occupied by a body (cell) is called volume." The rate of nutrients and rate of waste production are directly proportional to cell volume.

The cell takes up nutrients and remove wastes through it surface cell membrane.

A large cell volume demands large surface area but a large cell has a much smaller surface area to volume than smaller cell. Hence the cell membrane of a cell can serve their small volume more easily than the membrane of lager cell.

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Surface Area to Volume Ratio (SA/V):

1. It is the ratio between surface area and volume.
2. Each unit of volume requires a specific amount of surface area to supply its metabolism with raw materials.
3. The amount of surface area available to each unit of volume varies with the size of a cell.
4. As a cell grows its surface area to volume ratio decreases.

**Q26: Explain the process of transport of materials across the plasma membrane.
(BISE Malakand 2018)**

Ans. Cell membrane is being semi-permeable so various substances can move across it.

In this way it maintains the balance of material inside and outside the cell. Materials are move across cell membrane are done by the following ways:

1) Diffusion:

"The random movement of molecules from the region of higher concentration to the region of lower concentration is called diffusion."

1. It is a type of passive transport because it

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does not require energy.

2. Only small molecules can diffused across cell membrane such as water, oxygen and carbon dioxide.
3. Diffusion is slow but efficient and rapid enough to fulfill the requirement of a cell.

Example:

In the small intestine glucose is present in high concentration. It is diffused to villi of small intestine. Then it is stored in liver in the form of glycogen for future use.

2) Facilitate Diffusion:

The movement of molecule from the region of higher concentration to the region of lower concentration through trans-membrane protein is called facilitate diffusion.

Explanation:

Due to size and charge some molecules cannot diffused through cell membrane such molecules are transported through cell membrane by facilitate diffusion.

3) Osmosis (نوس): (BISE Malakand 2018)

The diffusion through semi-permeable membrane is called diffusion.

Types of Osmosis:

There are two types of osmosis:

(i) Exosmosis: (BISE Kohat 2015)

When materials (solvent) moves out from a cell.

(ii) Endosmosis: (BISE Kohat 2015)

When material (solvent) are moves into a cell.

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Examples:

There are few examples that explain how osmosis occurs.

(a) **Hypotonic Solution:** It is a solution which contains high water potential than a cell.

Effects:

When a cell is kept in hypotonic solution the water will move into the cell from surrounding as a result the animal cell swells and may rupture, while the plant cell becomes turgid.

(b) **Isotonic Solution:** (Iso-same, tonic-solution)

It is a solution that contains equal amount of solute to that of a cell.

Effects:

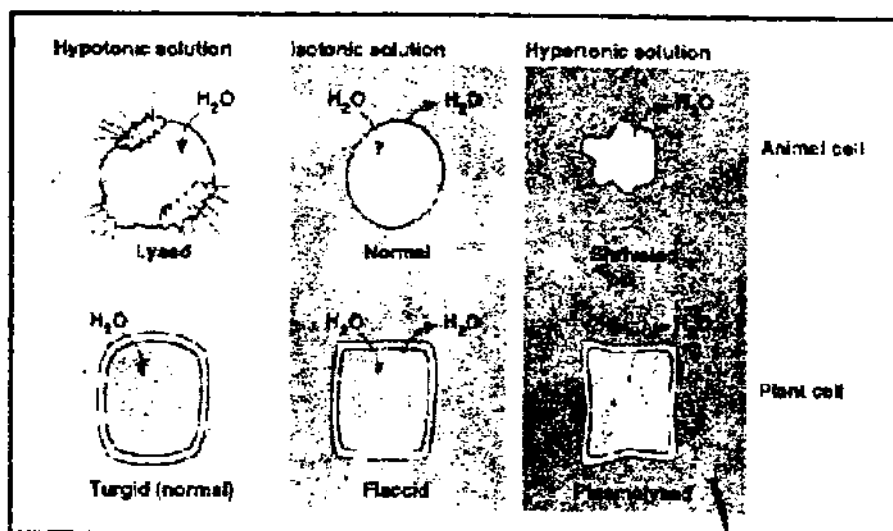
1. When a cell is placed in isotonic solution the rate of osmosis outward is equal to the rate of osmosis inward.
2. In such case animal cells retain their original volume while plant cells become flaccid (loose) because the net uptake of water is not enough.

(c) **Hypertonic Solution:** It is a solution which contains low water potential than the cell.

Effects:

1. When a cell is kept in hypertonic solution water moves out from the cell.
 2. In such cases animal cells shrink in size and in plant cells the cytoplasm shrinks within the cell wall.
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TURGOR:

A cell is said to be turgid when it absorbs water from surrounding.

Explanation:

When a plant cell is kept in hypotonic solution the water moves into the vacuole by osmosis. The vacuole increases in size and pushes the cell contents against the cell wall.

Turgor Pressure:

"The pressure exerted by the cytoplasm against cell wall is called turgor pressure and the phenomena is called turgidity." Plants cell does not burst when it is turgid because the cell wall is strong and relatively inelastic.

Importance of Turgor in Plants:

1. It maintains the shape of plant.
2. It provides support especially to young stem.
3. It helps in opening and closing of stomata.
4. Due to change in turgor some flowers open at

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day time and closed at night.

PLASMOLYSIS:

"The shrinkage of protoplasm due to loss of water by exosmosis is called plasmolysis."

Explanation:

1. When a plant cell is kept in hypertonic solution the water leaves the cell by osmosis.
2. First water leaves from cytoplasm and then from vacuole.
3. Due to outward movement of water from cell the cytoplasm shrinks and pulls away from cell wall. This process is called plasmolysis and the cell is said to be plasmolysed.
4. When a plasmolysed cell is kept again in a hypotonic solution it restores its turgidity. This phenomenon is called deplasmolysis.

ACTIVE TRANSPORT:

The movement of molecules against the concentration gradient i.e. from the lower concentration to higher concentration is called active transport. It uses energy.

Explanation:

For the active transport of substances carrier proteins are present in cell membrane that uses energy and move them from lower concentration to high concentration.

Examples:

Na^+/K^+ are actively transported across the membrane according to the requirement of the cell. i.e.

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in nerve impulse transmission Na is actively transported across nerve cell membrane.

**Q27: Explain exocytosis and endocytosis.
(BISE Kohat)**

Ans. 1) Endocytosis:

"The process in which substances are taken into the cell is called endocytosis."

These substances may be smaller or larger. They may be solid or liquid.

(i) Pinocytosis: Intake of liquid substance.

(ii) Phagocytosis: Intake of solid substance

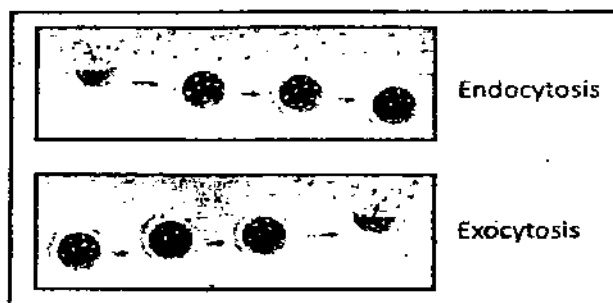
1. In endocytosis the cell membrane folds inwards forming a pocket which takes the material from the environment.
2. This pocket goes deepens forming a vesicle.
3. At last the vesicle separates from cell membrane and moves to inside the cell along with its contents.

2) Exocytosis:

"The process in which material are packed in a vesicle and excreted from a cell is called exocytosis."

Mechanism of Exocytosis:

1. The vesicle in which the material is packed are bind with cell



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membrane.

2. The phospholipid region of two membranes meet which creates an opening to the outside of a cell through which the material are removed from a cell.

Q28: Define filtration.

Ans: Filtration:

"The process in which small molecules are pushed across selectively permeable membrane is called filtration." It is done by hydrostatic or blood pressure.

Example:

Our kidney filters wastes and toxic substance from our blood and removes it from the body.

Q29: Define tissue. Explain different types of plant tissue. (BISE Bannu 2015, Kohat)

Ans: TISSUE: (BISE Abbottabad 2018)

"A group of cell that performs a particular function is called tissue."

Explanation:

1. The cells of the tissue are dependent on each other.
2. There are some organisms where cells grouped together but they do not form tissues because the cells are not dependent but function independently e.g. volvox.

Plant Tissue:

There are two types of plant tissues:

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1. Simple tissue
2. Compound tissue

1) Simple Tissue:

These tissues are composed of only one type of cell and perform specific functions.

Types of Simple Tissue:

There are further two types of simple tissues:

- a. Meristematic or embryonic tissue
- b. Permanent tissue

(a) Meristematic Tissue:

1. These cells have the ability of division.
2. They produce new cells at the growing parts of a plant.

Properties of Meristematic Tissues:

1. Its cell has dense cytoplasm.
2. It has large central nucleus.
3. They have small or no vacuole.
4. Cells are alike with no intracellular spaces.
5. They have thin walls.

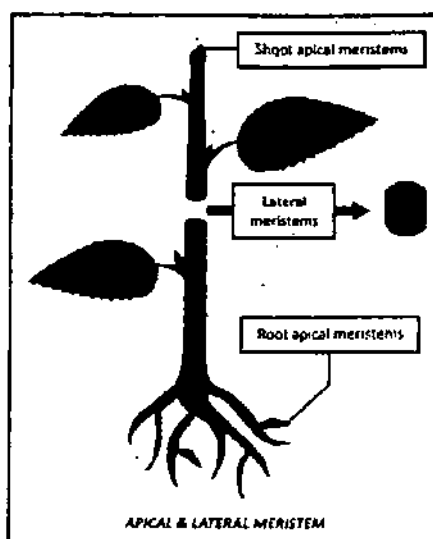
Types of Meristematic Tissues:

There are two types of meristematic tissues:

1. Apical meristem
2. Lateral meristem

1) Apical Mersitem:

1. It is present at the apex of roots and shoots.
2. Here the cells divides and redivides and results in the



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tion of stem and roots causing primary growth.

Primary Growth:

The increase in length or height of an organism is called primary growth.

Lateral Meristem:

It is present in the lateral sides of stem and roots. Here the cells divide and redivide resulting in secondary growth.

Secondary Growth:

The increase in thickness or diameter of an organism is called secondary growth.

2) Permanent Tissues:

"Those tissues whose cells lost the ability of division are called permanent tissues." They are originated from the primary meristem.

Types of Permanent Tissues:

There are three types of this tissue:

- a. Epidermal tissue
- b. Ground tissue
- c. Supporting or mechanical tissue

a) Epidermal Cells:

These tissues are present as outermost protective covering of stem, roots and leaves.

Characteristics:

1. They are flattened and irregular in shape.
 2. They are thick walled.
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3. They are closely packed with no intracellular spaces.

Functions:

1. In leaves it has small pores called stomata which help in exchange of gases.
2. In stem it is thick and contains a waxy layer so prevent transpiration.
3. It forms root hairs which absorb water from soil.

b) Ground Tissues:

These tissues are present in all parts of body except epidermal cell.

Characteristics:

1. They are thin walled.
2. It is made of parenchyma cell.
3. It is oval, spherical or polygonal in shape.

Functions:

1. In leaves it contains chlorophyll so help in photosynthesis.
2. They also store food.

c) Supporting Tissues or Mechanical Tissue:

These tissues provide strength and flexibility to the plant. They are thick walled cells.

Types of Supporting Tissue:

There are two types of supporting tissues:

- i) Collenchyma tissues
- ii) Sclerenchyma tissues

i) Collenchyma Tissues: These are elongated and oval cells. The cells of these tissues are living. It is found in young stem, petiole of lea. and pedicel of

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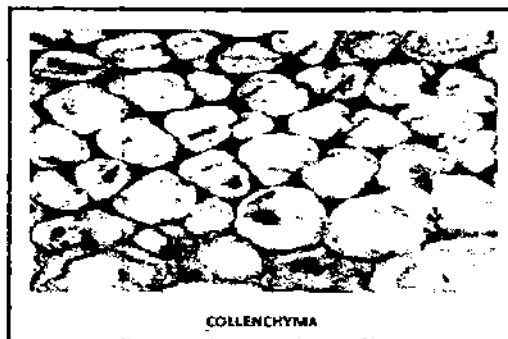
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a flower.

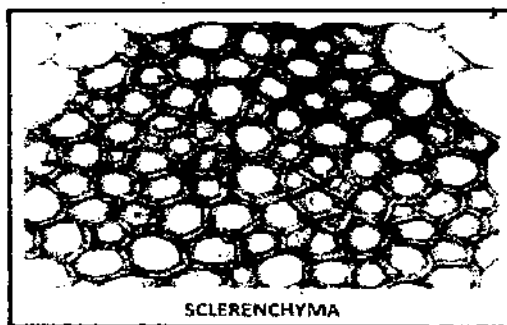
Functions:

1. It provides mechanical support to organs of a plant.
2. In leaves it acts as supporting tissues.



ii) Sclerenchyma Tissues: (Sclerous-hard)

These are thick walled cells. At maturity they lose protoplast and become dead. Their walls are filled with lignin which provides hardness and strength to the cell.



2) Compound Tissues:

These tissues are composed of different types of cells performing a common function. For example;

- i) Xylem
- ii) Phloem

i) XYLEM:

These are plant tissues which are responsible for the transportation of water and dissolved minerals and salts. They transport water and minerals from roots to the upper parts of the plant.

Structure of Xylem:

It is composed of three types of cells:

- a. Vessels

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b. Tracheids

c. Fibers

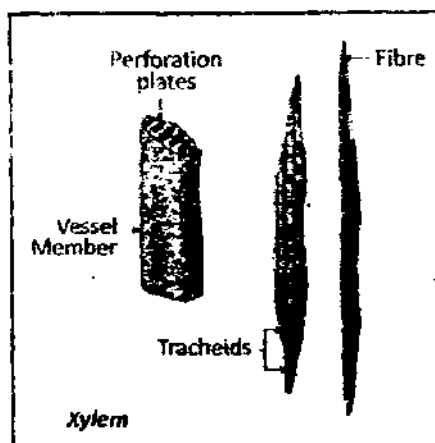
a. Vessels: These are elongated cells specialized for the conduction of water.

1. They are wider and shorter cells.
2. They are connected end to end which form a continuous channel.
3. They become dead at maturity.

b. Tracheid: These are narrow and elongated cells. They have tapered end at both sides.

Pits: These are small pores in xylem which maintain the flow of water.

c. Fibers: These are elongated and thick walled cells with tapering end. Their cell wall contains lignin. They act as supporting tissue.



ii) PHLOEM:

These are plant tissues which are responsible for the transportation of prepared food.

Translocation:

The movement of prepared food in the plant body is called translocation.

Structure:

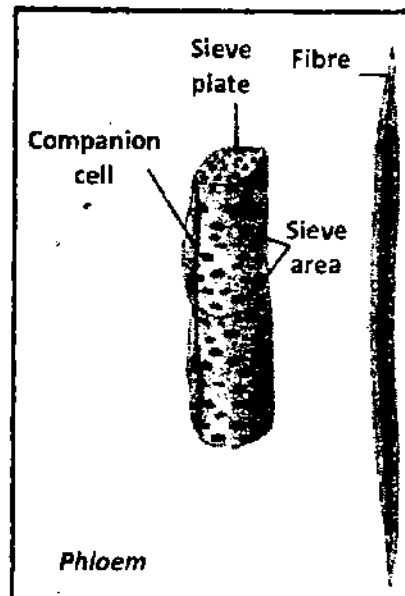
It is composed of two types of cells:

- a. Sieve tube
- b. Companion cell

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a. Sieve Tube: These are elongated living cells which are porous at ends. They are connected to each other through sieve plates. Their protoplasm has no nucleus. It is surrounded by a thick wall of cellulose.

b. Companion Cells: These are elongated thin walled cells around each sieve tube. They contain cytoplasm and nucleus. They regulate the movement of food through sieve tubes.



Q30: Discuss different types of animal tissues.

Ans: Animal Tissue:

On the basis of structure and function animal tissues are classified in four main types:

1. Epithelial tissue
2. Connective tissue
3. Muscular tissue
4. Nervous tissue

1) Epithelial Tissue:

These tissues cover the internal organs and also make internal lining of organs. Skin is made of epithelium which covers the internal organ and separates them from physical environment. These are elongated and flat cells. These also make the internal lining of intestine and lungs.

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2) Connective Tissue:

These tissues connect various parts of the body to each other. It is the major supporting tissue of animal body.

Types of Connective Tissue:

i) Loose Connective Tissues:

1. Its extracellular material contains loosely packed collagen fiber.
2. It holds organs at their specific place.
3. It is widely distributed under epithelial tissues.

ii) Fibrous Connective Tissue:

1. Its extracellular material contains tightly packed collagen.
2. It occurs in the form of tendons and ligaments.

Tendons: It attaches muscle to bone.

Ligament: It attaches bone to bone.

iii) Adipose Tissue:

1. It contains swollen cells because it contains large number of fats droplets.
2. It provides energy and insulates organs against heat loss.
3. It protects and support organs.
4. It is present under the skin and around kidneys.

iv) Cartilage:

1. Its extracellular material contains a bundle of collagen fibers and rubbery substance.
 2. It is present at the end of bones, external ear, nose, trachea and larynx.
 3. It provides support and maintains shape.
-

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v) Bone:

1. It is a hard structure which makes endoskeleton.
2. Its extracellular material contains collagen fiber and calcium salt.
3. It supports, protects, provide lever system for movement, stores calcium and forms blood cells.

vi) Blood:

1. It is a special type of connective tissue.
2. Its extracellular material is plasma, which is a fluid.
3. It transports nutrients and gases in the body.
4. It also helps to fight against germs.

3) Muscular Tissue:

These tissues have the ability of contraction and relaxation. It is composed of elongated cells which are contractile in nature.

Types of Muscles:

There are three types of muscles:

- i) Skeletal muscle
- ii) Smooth muscle
- iii) Cardiac muscle

i) Skeletal Muscle:

1. These muscles are found on external body surface.
2. They are attaches to bones and cartilage by tendons.

Properties:

1. They are long and cylindrical.
 2. They have striation (light and dark bands when seen under microscope).
-

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3. They are voluntary in action.
4. They are multi-nucleated.
5. It helps in movement.

Examples: bicep and tricep.

ii) Smooth Muscle:

The muscles are found in the walls of hollow organs
i.e. blood vessel, intestine and stomach etc.

Properties:

1. They are involuntary.
2. They do not get fatigue easily.
3. They are spindle in shape.
4. They have no striation.
5. They contract slowly.

iii) Cardiac Muscle (Card-Heart):

These muscles are only found in heart.

Properties:

1. They are involuntary in action.
2. They have striation.
3. They do not get fatigue.
4. They are branched shaped e.g. myocardium.

4) Nervous Tissue:

These tissues are responsible for the conduction of messages in the body. It contains neurons which carry informational signals in the body. It is present in brain, spinal cord and other parts of body.

EXERCISE

A. Encircle the best suitable answers.

1. Schleiden and Schwann proposed the cell theory on the basis of:
✓ (a) Their observation
(b) Observation of Hooke and Brown
(c) All observation on the cell.
(d) Observation made on the nucleus of the cell
 2. The organelle which provides energy to the cell:
(a) Golgi apparatus (b) Ribosome
✓ (c) Mitochondria (d) Nucleus
 3. We obtain 2D images through:
(a) Light microscope and SEM
(b) SEM and TEM
✓ (c) Light microscope and TEM
(d) Light microscope
 4. Inside the nucleus, granular material is called:
(a) Cytoplasm (b) Protoplasm
✓ (c) Nucleoplasm (d) Cell sap
 5. The organelle involved in protein synthesis is:
✓ (a) Ribosome (b) Vacuole
(c) Golgi apparatus (d) Plastids
 6. The nervous tissue has the ability to:
(a) Contract and relax
✓ (b) Transmit the impulses
(c) Prepare secretion
(d) Provide energy
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7. In plants, which tissue makes new cells?
✓ (a) Meristematic tissue
(b) Collenchyma tissue
(c) Epidermal tissue
(d) Ground tissue
8. Movement of molecules from lower to higher concentration with the expenditure of energy is:
(a) Diffusion ✓ (b) Active transport
(c) Facilitated transport (d) Osmosis
9. One of the following has both cytoplasm and cell wall:
(a) Muscle cell (b) Red blood cell
✓ (c) Root hair cell (d) Xylem vessel
10. Cell membrane is made of:
(a) Cellulose only
(b) Lipids only
(c) Lipids only
✓ (d) Lipids and proteins
11. Cell wall is present in the cells of:
(a) Fungi only (b) Plants only
(c) Plants and prokaryotes only
✓ (d) All of the above
12. Which organelles are covered with a double membrane?
(a) Ribosomes
(b) Vacuoles
(c) Centrioles
✓ (d) Mitochondria
-

Short Questions

B. Write short answers for the following questions:

Q1: What proposed the cell theory and what are the main points of the cell theory?

Ans. Cell theory was proposed by two scientists named Schleiden and Schwann.

Main Points:

1. All living organisms are made of cells.
2. Cell is the basic unit of structure and function of living organisms.
3. All metabolic process occurs in a cell.
4. Cell contains heredity material which passes characters from parents to offspring.
5. New cells are arised from old cells.

Q2: Differentiate between simple and compound tissue. (BISE Swat 2017)

Ans.

Simple Tissue	Compound Tissue
1. Also called embryonic tissue.	Also called permanent tissue.
2. It is made of one type of cell.	It is made of different types of cell.
3. It has the ability of division.	They lack the ability of division.
4. They are concerned with primary and sec-	They acts as supporting tissue and provides

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ondary growth of plant. e.g. epidermal tissue	strength to plant. e.g. xylem, phloem
--	--

Q3: How cell membrane helps in maintain equilibrium while exchanging materials with environment?

Ans: Cell membrane covers the surrounded by each and every cell. It is being selectively permeable so allow the movement of some molecules.

1. It absorbs nutrients from surrounding if needed.
2. It eliminates extra water and waste material from the cell.
3. By performing the above process cell membrane maintains the equilibrium of materials inside the cell.

Q4: Differentiate between endocytosis and exocytosis? (BISE Malakand 2018)

Ans:

Endocytosis	Exocytosis
1. In this process substances are taken into the cell.	In this process substances are removed from cell.
2. In this the material form a packet in cell membrane when enters.	Here the material is packed in a vesicle when removed.

Q5: How does turgor pressure develops in a plant cell?

Ans: Turgor Pressure:

1. It is the pressure exerted by cytoplasm against

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cell wall.

2. When a plant is surrounded by water, the water moves into the cytoplasm and then to vacuole.
3. When vacuole takes water it increases in size which pushes the cytoplasmic content to put pressure on cell wall, so a pressure is developed called turgor pressure.

Long Questions

C. Write detailed answers for the following questions:

Q1: Root hairs are adapted to absorption and xylem to support. Relate the functions to their structure.

Ans. Root Hairs:

1. These are small hair like structure arises from roots.
2. For the absorption of water it increases the surface area of roots.
3. They spread in soil and reaches to water table of earth.
4. They are also thin walled.
5. So the root hairs are designed for the absorption of water and dissolved minerals.

Xylem:

1. Xylem conducts water in plant body. It also gives support to plants.
2. The cells of xylem are placed on the top of

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each other such that it forms a long tube in middle of stem and branches. This design helps them to conduct water and provide support.

Q2: Discuss different types of tissues in plants. Elaborate your answer with relevant diagrams.

Ans: Please see Question number...

Q3: Describe the nervous, muscular and epithelial tissues.

Ans: Please see Question number...

Q4: Write a note on the structure of cell wall, cell membrane, mitochondria and chloroplast of a plant cell.

Ans: Please see Question number...



- ✿ محنت اتنی خاموشی سے کرو کہ تمہاری کامیابی شور مچا دے۔
- ✿ محنتی شخص کے سامنے پہاڑ ٹکڑے ہو جاتے ہیں اور کامل انسان کے سامنے ٹکڑے ہو جاتے ہیں۔
- ✿ اگر آدمی کی نیت درست ہو اور وہ کوشش شروع کر دے تو اللہ تعالیٰ کی مدد آجایا کرتی ہے۔
- ✿ جن کا بھروسہ اللہ تعالیٰ ہو، ان کی منزل کامیابی ہے۔
- ✿ اللہ تعالیٰ کی رحمت کی پہلی نشانی یہ ہے کہ انسان کو اپنے عیب نظر آنے شروع ہو جاتے ہیں۔
- ✿ جب زمانہ مشکل میں ڈال دیتا ہے تو میرا رب ہزار راستے کھول دیتا ہے۔
- ✿ آنکھ کی توبہ حرام چیزیں نہ دیکھنے میں ہے۔

CHAPTER

4

CELL & TISSUE

Q1: Define cell. What is unicellular and multi-cellular organism? خلیہ کیا ہے؟

Ans. Cell:

Cell is derived from a Latin word "cellula" which means small room. Cell is a unit surrounded by membrane. It is the basic structural and functional unit of life.

Unicellular Organisms: (uni-one, cellular-cell)

"Those organisms which contain only one cell are called unicellular organisms." e.g. bacteria and amoeba etc.

Multi-cellular Organisms: (multi-many, cellular-cell)

"Those organisms which are composed of many cells are called multi-cellular." e.g. human and mustard.

Q2: What is microscope? Define microscopy.

Ans. Microscope: (micro-small, scope-to look)

A device by the help we can see those objects that are too small to naked eyes.

Microscopy:

"The use of microscope the study cell and its components is called microscopy."

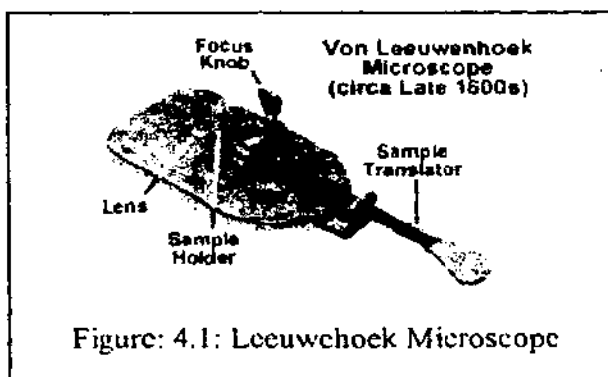
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Development of Microscope:

1. The first microscope was developed by Zacharias Janseen in Holland in 1695.
2. It was simply a tube with lenses at each end.
3. Its magnification power is 3x to 9x.

Antonie Van Leeuwenhoek:

Leeuwenhoek was a Dutch scientist made a much better microscope to observe small organisms. Its magnification power is 250x. He is considered to be the 1st microscopist.



Q3: Define magnification and resolution.

Ans: Magnification:

"The ability of microscope to enlarge the actual size of an object is called magnification." It is expressed in units abbreviated as x e.g. 10x, 20x etc.

Resolution:

"The ability of microscope to separate the two close

objects is called resolution." Resolving power of human eye = 0.7mm.

For Your Information:

Magnification power of light microscope = 1500x.

Electron microscope = 250,000x

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Q4: What are the different types of microscope?

Ans- 1) Simple Microscope:

The microscope which does not need electricity to illuminate object. It contains one lens.

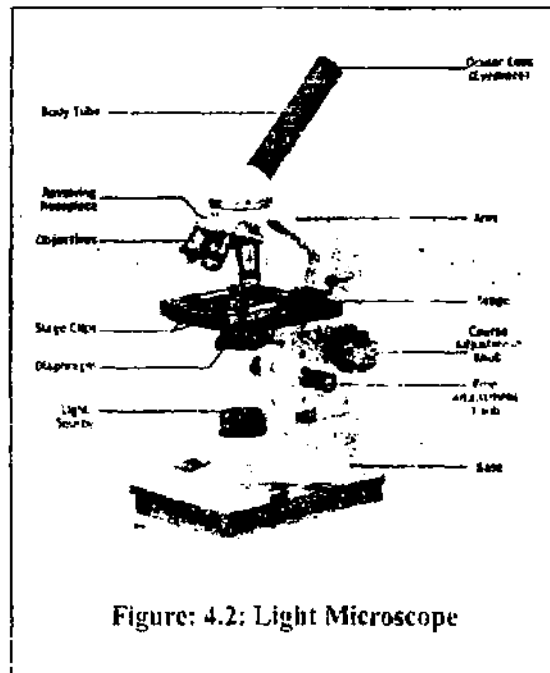
2) Light Microscope:

"The microscope which needs electricity to illuminate object is called light microscope."

1. It contains two lenses.
2. Its magnification power is $= 1500\times$.
3. Its resolving power is $0.2\mu m$.

Mechanism of Image Formation on Light Microscope:

1. Light passes through the sample and then through two glasses lenses.
2. The first lens produce enlarge image while the second lens magnifies this image more.
3. The light after passing the object and lens it is projected into viewer's eye where an enlarge and clear image is formed.



3) Electron Microscope:

This microscope uses beam of electron instead of

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light. In this magnetic lens focus the electron beam on a screen or photographic film and make much enlarge image. Its resolving power is 0.2nm .

Types of Electron Microscope:

There are two types of electron microscope:

(i) Transmission Electron Microscope (TEM):

This microscope is used to study the cell internally. Its magnification power is 250,000.

(ii) Scanning Electron Microscope (SEM):

This microscope is used to study the surface of a cell. The surface of a cell is coated with metal. When electron beam hits this metal it is reflected and makes the enlarge image.

Q5: Compare between light and electron microscope.

Ans:

	Light microscope	Electron Microscope
Radiation Type	Light	Beams of electrons
Lenses	Optical	Magnetic
Magnification	10,000 time greater than naked eye	100 time greater than light microscope
Resolution	500 times of the naked eye	400 times of light microscope
Image	2D image	3D image

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Q6: Discuss history of emergence of cell theory.

Ans: History of Emergence of Cell Theory:

Various scientists play role in the formulation of cell theory. Some are given below:

1) Robert Hook:

1. He was an English microscopist.
2. He was the first person that observes a cell under microscope.
3. He studied a thin slice of cork which is made of wood under his self designed microscope.
4. In this he saw small chambers which are given the name cellula.

2) Antonie Van Leeuwenhoek:

1. He was a Dutch scientist.
2. He made much powerful microscope.
3. Through his microscope he study a drop of water and saw tiny unicellular creature in it.
4. He called these creatures as "animalcules" swimming around.

3) Jean Baptiste De Lamarck:

1. He was a French scientist.
2. He also observed cell when he examined the pair of animals and plants under microscope.
3. He concluded that all living organisms are made of cellular tissues.

4) Robert Brown:

1. He was a British botanist.
2. He describes nucleus in a cell and made a new concept that the center of cell is not empty.

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5) Mathias Schleiden:

He was a German botanist. He claimed that all plants are made of cells.

6) Theodor Schwann:

He was German zoologist. He claimed that all animals are made of cells.

7) Jan Evangelista Purkinji:

He was a Czech scientist. He discovered the fluid substance in a cell and called it protoplasm.

8) Rudolf Virchow:

1. He was a German pathologist.
2. He stated that every cell arises from pre-existing cell.

9) Louis Pasteur:

1. He was a French scientist.
2. He proved experimentally the idea of Virchow.
3. He demonstrated that bacteria could be formed only from pre-existing bacteria.

**Q7: What are the main points of cell theory?
(BISE Abbotabad 2014, Malakand 2016)**

Ans. Cell theory was formulated by Theodor Schwann and Matthias Schleiden in 1838.

Main Points:

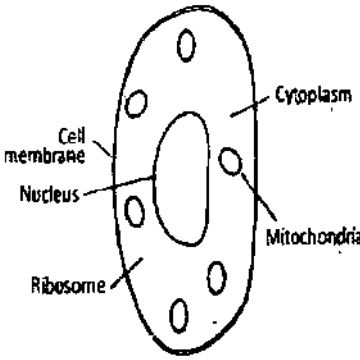
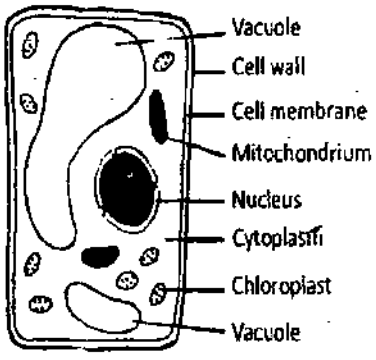
1. All organisms are made of cells i.e. unicellular and multi-cellular.
 2. Cell is the basic structural and functional unit of life.
 3. New cells arise from pre-existing cells by cell division.
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4. Cell contains genetic information which are transfer to next generation.

Q8: Differentiate between animal and plant cell.

Ans:

Animal Cell	Plant Cell
1. It is comparatively small.	It is large.
2. Cell wall is absent.	Cell wall is present.
3. Nucleus occurs in center	Nucleus occurs at one side.
4. They have more numbers of mitochondria.	They have less numbers of mitochondria.
5. Chloroplast is absent.	Chloroplast is present.
6. They have many small vacuoles.	They have one large vacuole.
 <p>Animal Cell</p>	 <p>Plant Cell</p>

Q8: What is cell wall? Write its functions.

Ans: Cell Wall:

1. It is the outermost wall of plant cell. Its thickness is change from cell to cell.
2. It is absent in animal cell.
3. It is also present in bacteria and fungi.

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Chemical Composition:

1. In Plant cell it is composed of cellulose.
2. In fungi it made of chitin.
3. In bacteria it is made of murine.

Components of Cell Wall:

Cell wall is composed of three layers:

1) Primary Wall:

It is the first wall which is composed of mainly cellulose.

2) Secondary Wall:

It is formed on the inner side of primary wall. It is tough and strong. It is composed of cellulose, hemicelluloses and lignin.

3) Middle Lamella:

It is a layer which is found between two cells. It is composed of calcium and pectin.

Functions:

1. It provides shape to the cell.
2. It gives support to the cell.
3. It is a permeable membrane for diffusion and helps in the absorption of minerals and solutes along with water.

Q10: Write a note on structure and function of cell membrane. (BISE Mardan 2016, Swat 2017)

Ans: Cell Membrane:

1. It is the outermost boundary of animal cell.

Other names of plasma membrane:

1. Cell membrane
2. Plasmallema
3. Cytoplasmic membrane

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2. In plant cell it lies next to cell wall.

3. It is thin and elastic.

Chemical Composition:

Chemically it is composed of:

1. Proteins (60-80%)

2. Carbohydrates (2-10%)

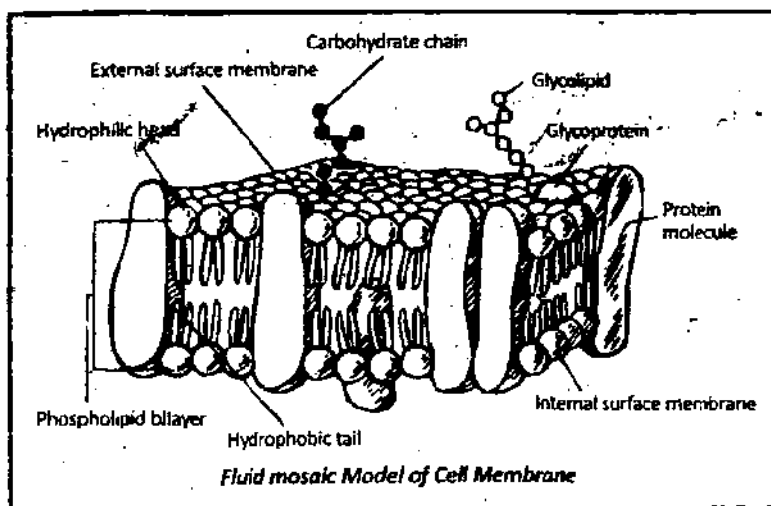
3. Lipids (20-40%)

Structure of Cell Membrane:

There are various models about the structure of cell membrane but the most accepted model is fluid mosaic model.

Fluid Mosaic Model:

This model was proposed by Singer and Nicolson in 1972.



Statement:

"Cell membrane is composed of two layers of lipids called lipid bilayer." In these two layers some proteins are floats while some are embedded or fix in the membrane of lipids. Some carbohydrates molecules are attached to protein forming glycoproteins.

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Functions:

1. It protects the inner content of a cell.
2. It gives strength to the cell.
3. It provides mechanical support to the cell.
4. It excretes wastes products from cell.
5. It also secretes useful substance from cell such as enzyme and hormones.
6. It is being semi-permeable so allow some material to pass through it.

Q11: Explain cytoplasm.

Ans. Cytoplasm:

"The space or region between cell membrane and nucleus is called cytoplasm." It is colourless and concentrated fluid. It is elastic.

Composition:

1. It is mostly contain of water (90%).
2. It also contains organic and inorganic substances.

Parts of Cytoplasm:

It is composed of two parts:

1. Cytosol
2. Insoluble part

1) Cytosol:

1. It is the soluble part of cytoplasm.
2. It is aqueous and dissolve a great variety of substances.
3. It contains soluble protein and vitamins.

2) Insoluble Part:

It is insoluble part which contains cytoplasmic structures such as mitochondria, endoplasmic reticulum and ribosome etc.

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Functions:

1. It is a store house for various organelles.
2. It is a site for various biochemical reactions.
3. It contains cytoskeleton that provides support to the cell.

Q12: Discuss endoplasmic reticulum.

Ans: Endoplasmic Reticulum:

Endo-inside, plasmic-cytoplasm, reticulum-network

It is a network of flattened membrane extended throughout the cytoplasm. It forms a connection between cytoplasm and nucleus.

Discovery:

It was discovered by Porter in 1953.

Types:

Endoplasmic reticulum are of two types:

1) Smooth Endoplasmic Reticulum (SER):

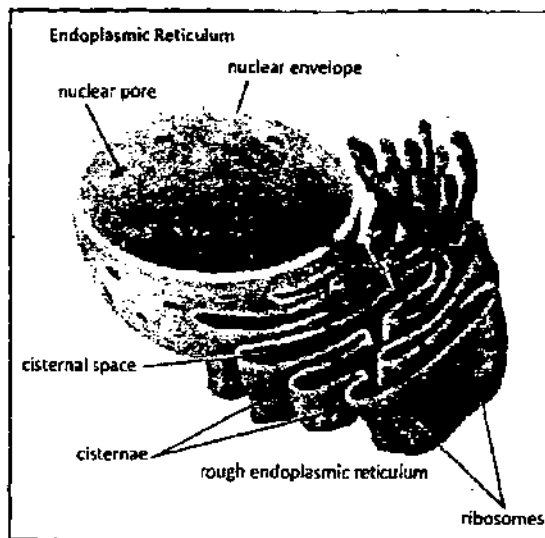
It is non-granular due to the absence of ribosome on its surface.

2) Rough Endoplasmic Reticulum (RER):

It is rough or lar due to the attachment of ribosome to its surface.

Functions:

1. It exchanges materials between



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lasm and nucleus.

2. It provides a platform for the attachment of ribosome.
3. RER helps in protein synthesis.
4. SER helps in lipids metabolism.
5. SER helps in detoxification of drugs.
6. SER helps in synthesis of vitamin D.

Q13: Write a note on structure of Golgi bodies.

Ans. Golgi Bodies:

It is a double membrane bound structure present in the cytoplasm of eukaryotic cells. It contains stacks of flattened sac called cisternae.

Discovery:

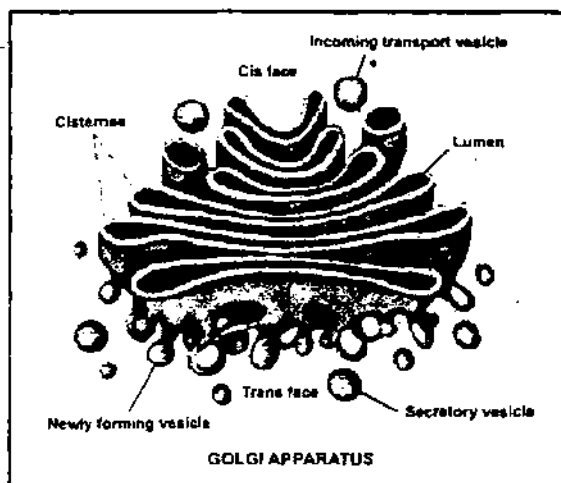
It was discovered by an Italian neurologist Camillo Golgi in nerve cell in 1998.

Structure of Golgi Bodies:

1. It contains flattened stacks which grouped together forming cisternae.
2. These cisternae are dilated at margins.
3. It also contains rounded sacs called golgi vesicles.
4. These vesicles contain zymes and inorganic salts.

Functions:

1. It stores



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cretions and convert them into final product (form).

2. It is involved in packaging of materials.
3. It helps in the formation of new plasma membrane.
4. From plant cell it secretes waxes, gums and mucilage.

**Q14: Write a note on mitochondria.
(BISE Abbottabad 2018)**

Ans. Mitochondria: (Mito-thread, condrion-small grain)

These are granular bodies found in the cytoplasm of eukaryotic cell. It is surrounded by double membrane.

Discovery:

It was discovered by Kooliker in 1850 in skeletal muscle. Its number is different from cell to cell in animals.

Components:

It is composed of three components:

1. Outer membrane
2. Inner membrane
3. Matrix

1) Outer Membrane:

It is smooth and made of lipids and proteins.

2) Inner Membrane:

This membrane is folded inward forming cristae.

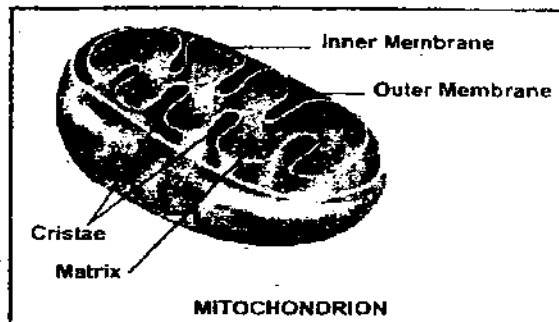
3) Matrix:

It is inner dense portion of mitochondria. It contains various enzymes.

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Functions:

1. It is involved in cellular respiration. So release energy from food.
2. It is also called power house of the cell because it releases energy (ATP).



Q15: What is ribosome?

Ans. Ribosome:

These are small, dense, rounded and granular particles occur in a cell. They may occur free in cytoplasm or attached with endoplasmic reticulum.

Discovery:

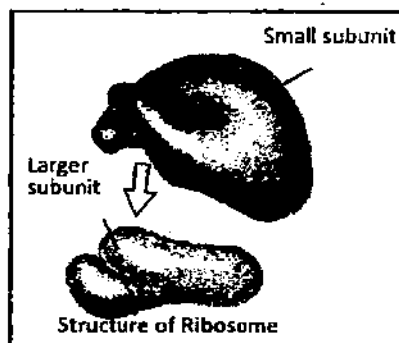
It was discovered by Palade in 1955.

Chemical Composition:

It is composed of proteins and ribosomal RNA.

Structure of Ribosome:

1. Each ribosome is composed of two small units.
 - Small sub unit
 - Large sub unit
2. Small sub unit is small in size and occurs above large sub unit.
3. The two sub units are joins together by high concentration of Mg^{++} .



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Types of Ribosome:

There are two types of ribosome:

1. 70s: It is found in bacteria.
2. 80s: It is found in eukaryotic cell.

Function:

Protein synthesis

**Q16: Write a note on plastids.
(BISE Abbottabad 2014)**

Ans. Plastids:

1. It is membrane bounded organelle present only in plant cells.
2. They contain special pigments.
3. They are spherical like in shape.

Types of Plastids:

On the basis of functions and pigments there are three types of plastids:

1. Chloroplast
2. Chromoplast
3. Leucoplast

1) Chloroplast: (Chloro-chlorophyll, plast-plastid)

1. These are green plastids.
2. It contains green pigment called chlorophyll.
3. It is the most abundant and important plastids.

Structure of Chloroplast:

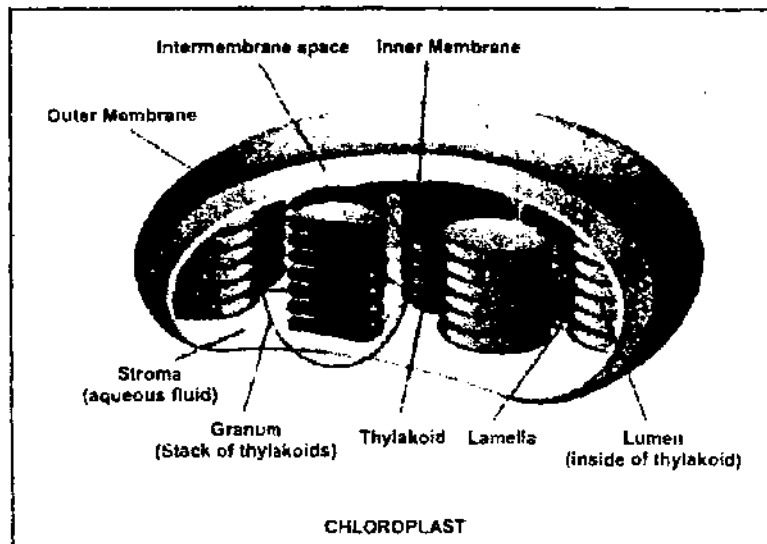
It consists of three main components:

1. Envelope
2. Grana
3. Stroma

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(i) Envelope: It is the outer double layer covering of chloroplast. It enclosed the grana and stroma.



(ii) Grana: It contains many flattened fluid filled membrane called thylakoid. These thylakoid are grouped together forming a granum.

(iii) Stroma: It is the central space inside the envelope. It contains various enzymes and ribosomes.

2) Chromoplast: (Chromo-colour, plast-plastid)

1. These are colours other than green.
2. They may be red, yellow, pink and blue etc.
3. They are mostly found in flowers and fruits.
4. Due to its bright colour it attracts insects for pollination.

3) Leucoplast: (Leuco-white, plast-plastid)

These are colourless plastids. It is mostly found in food storage part of plant i.e. roots.

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Functions of Plastids:

1. Chloroplast helps in photosynthesis.
2. Chromoplast acts to attracts insects for pollination.
3. Leucoplast acts to store food for plants.

Q17: Discuss cytoskeleton. (BISE Kohat 2017)

Ans. Cytoskeleton:

It is a network of protein filament extended throughout the cytoplasm.

Types

1. Microtubule
2. Macro filament
3. Intermediate filament

1) Microfilament:

It is small rod like structure extended in cytoplasm.
It occurs in the form of bundles.

Functions:

1. It plays role in muscle contraction.
2. They give support and strength to the cell.

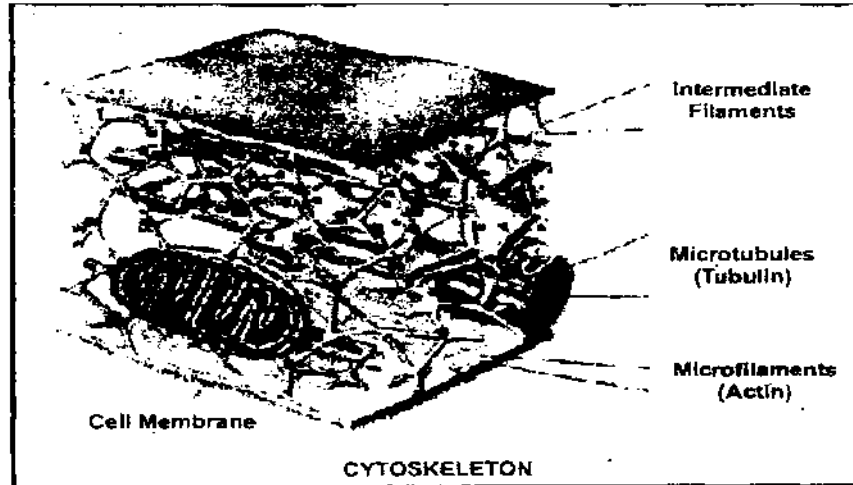
2) Microtubule:

It is a microscopic tubular structure present in the cytoplasm. It is made of globular protein.

Functions:

1. It forms spindles fiber of the dividing cell.
 2. It is involved in the formation of centrioles, cilia and flagella.
 3. It provides support and strength to the cell.
-

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3) Intermediate Filament:

These are intermediate between microtubule and microfilament.

Functions:

1. *It provides mechanical support to the cell.*
2. *It maintains shape of the cell.*

Q18: What is centriole?

Ans. Centriole:

*It is a cylindrical organelle present near the nucleus.
It occurs in pair form.*

Size:

It is about 0.3 - 0.5 μm in length and 0.2 μm in diameter.

Structure:

Under electron microscope the cross section of centriole is:

1. *It contains nine sets of microtubule.*
2. *Each set of microtubule is composed of three microtubules.*

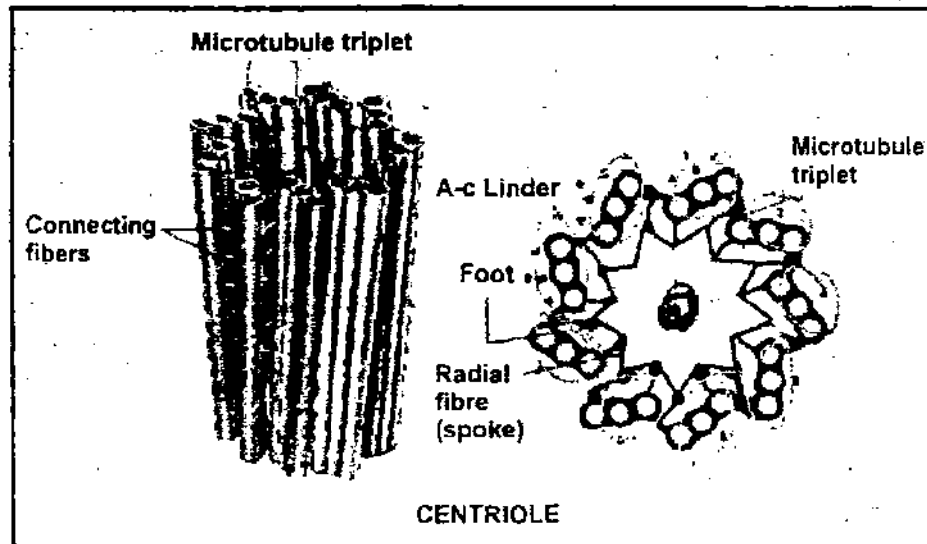
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3. Total number of microtubule in one centriole is 27.

Functions:

1. It is involved in cell division.
2. It also helps in the formation of cilia and flagella.



Q19: Discuss vacuole.

Ans: Vacuole:

It is a fluid filled single membranous sac present in eukaryotic cell. The membrane of vacuole is called tonoplast.

Explanation:

1. Animal cell contains many small vacuoles.
2. Plant cell contains one large vacuole.
3. There are two types of vacuole:
 - a. Food vacuole
 - b. Contractile vacuole

Composition of Vacuole:

The fluid of vacuole contains water, salts, amino

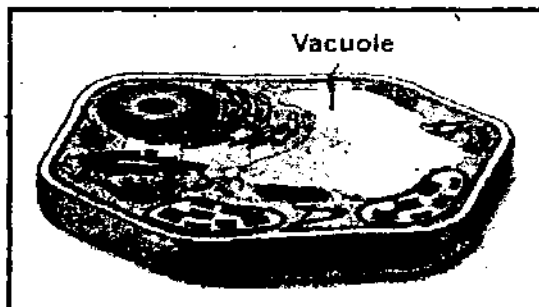
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acids, vitamins, pigments and other materials.

Functions:

1. Food vacuole helps in intake and storage of food.
2. Contractile vacuule removes wastes from the cell.
3. It increases the size of cell by absorbing water.



Q20: What is lysosome.

Ans. Lysosome: (Lyso-splitting, soma-body)

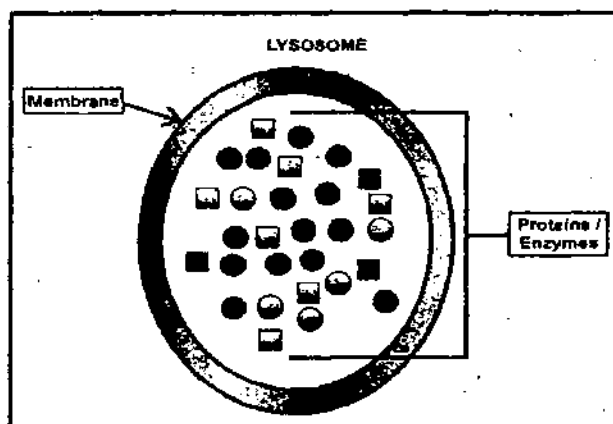
It is a single membrane bounded organelle present in eukaryotic cell.

Discovery:

It was discovered by C. de Duve in 1955.

Occurrence:

It occurs in most animal cells and in few plants.



Chemical Composition:

It composed of many enzymes such as proteases, nucleases, lipases and phospholipase.

Functions:

1. It helps in digestion of food.

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2. It eats microorganisms that enter the cell.
3. It also play role in development process.

Q21: Write the structure and function of nucleus.

Ans. Nucleus:

It is the most important and prominent body of eukaryotic cell.

Discovery:

It was discovered by Robert Brown in 1838.

Components of Nucleus:

It is composed of four components:

1. Nuclear membrane
2. Nucleoplasm
3. Nucleolus
4. Chromosome

1) Nuclear Envelope:

It is a double membrane structure surrounded by nucleus. It separates nuclear material from cytoplasm.

2) Nucleoplasm:

It is a semi liquid matrix in nucleus. It contains enzymes, proteins and minerals.

3) Nucleoli:

It is a spherical structure inside the nucleus. They may be one or two in number. It forms ribosome.

4) Chromosome: (Chroma-colour, soma-body)

1. These are thread like structure present inside the nucleus.
2. It is the main structure inside the cell.

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3. It was discovered by Waldeyer in 1876.
4. Chromosome is more visible during metaphase phase of cell division.

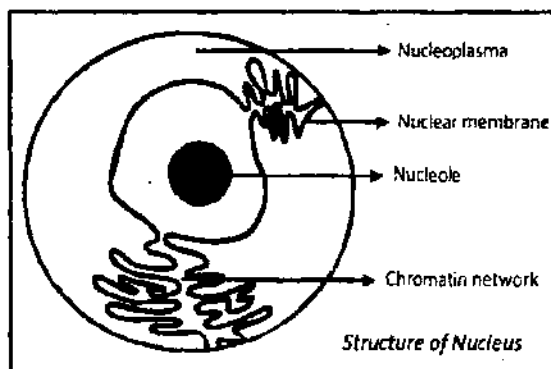
Composition:

Chromosome is composed of proteins (55%) and DNA (45%).

Number of Chromosomes:

Every specie have different numbers of chromosomes.

- Human: 46
- Frog: 26
- Radish: 18
- Onion: 16



Functions:

1. It is the cell control room of the cell.
2. It helps in cell division.
3. It transfers the characters from parents to offspring.
4. It also synthesizes ribosome.

Q22: Differentiate between prokaryotic and eukaryotic cell.

Ans.

Prokaryotic Cell	Eukaryotic Cell
Pro-before, karyon-nucleus	Eu-true, karyon-nucleus
1. True nucleus is absent.	True nucleus is present.
2. Membrane bounded organelle is absent.	Membrane bounded organelle is present.

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3. Chromosome is dispersed in cytoplasm.	Chromosome is present in nucleus.
4. They have small size ribosome: 70s	They have large size ribosome: 80s
5. Cell wall is made of murine.	Cell wall is made of cellulose (plants) or chitin (bacteria)
6. It is simple.	It is complex.
7. They are comparatively small in size. Example: Bacteria	They are comparatively larger in size. Example: Protista, plant, fungi and animals

Q23: Explain cell and their specificity.

Ans. Cell and their Specificity:

It means that in multicellular organisms every cell of the body is specific to its function. But in unicellular organisms its one cell performs all the activities of life.

Examples in Plants:

1. In plant cell xylem is specialized to conduct water.
2. Phloem is specialized to transport food materials.
3. Similarly there are cells which are specialized for photosynthesis.

Examples in Animals:

1. In animal's nerve cell are specific to carry nerve impulse.
2. Muscle cells undergo contraction and relaxation hence play role in body movement.
3. Red blood cells (RBC) transport oxygen.
4. WBC kills pathogens.

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Every Cell is Specialized for its Function:

1. e.g. nerve cells are long for the transmission of nerve impulse.
2. RBCs are disc like and biconcave in shape so increase the surface area to volume ratio for binding and transporting oxygen.
3. Root hair cell have large surface area to absorb more water.
4. Cells that are involved in making secretion have complex endoplasmic reticulum and golgi bodies.
5. Cell that performs photosynthesis have chloroplast.

Q24: How cell is an open system?

Ans. Cell is an open system because it takes substance in from surrounding needed for its activities.

1. These substances are taking in through cell membrane.
2. Then it performs metabolic process assigned to it.
3. After metabolism products and by-products are formed.
4. These products are either utilizes the cell by itself or transfer to other cell.
5. The by-products are expelled out from the cell.

Q25: Discuss surface area to volume ratio.

Ans. Surface area is the external surface of a cell which is exposed to outer environment.

Explanation:

As a rule large cells have less surface area in relation to their volume while small cell have more surface area. For example;

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1. We have two cells that is larger cell A and small cell B.
2. Cell A have larger surface area than cell B.
3. In figure shows one larger cell and 27 small cells.
4. In both cases the total volume is same i.e.
 $\text{Volume} = 30\mu\text{m} \times 30\mu\text{m} \times 30\mu\text{m} = 27000\mu\text{m}^3$
5. In contrast to the total volume, the total surface area are very different because the cell have 6 sides, its surface area is 6 times the area of one side.

The surfaces of these cells are as follow:

1. Surface area of one large cell
 $= 6 \times (30\mu\text{m} \times 30\mu\text{m}) = 5400\mu\text{m}^2$
2. Surface area of one small cell
 $= 6 \times (10\mu\text{m} \times 10\mu\text{m}) = 600\mu\text{m}^2$
3. Surface area of 27 small cells:
 $= 27 \times 600\mu\text{m}^2 = 16,200\mu\text{m}^2$

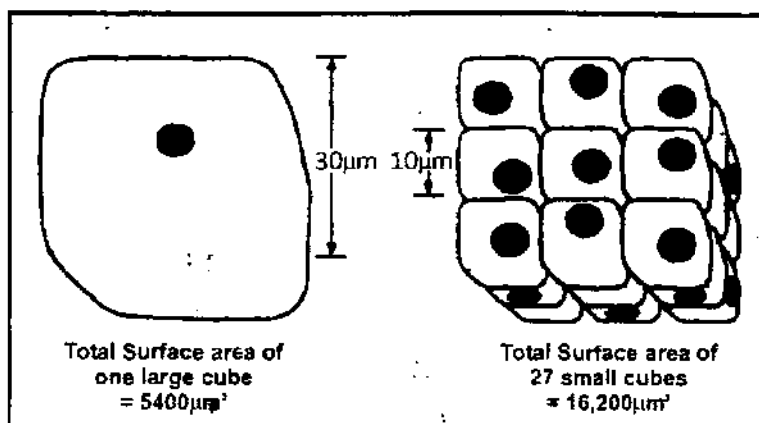
Volume:

"The space occupied by a body (cell) is called volume." The rate of nutrients and rate of waste production are directly proportional to cell volume.

The cell takes up nutrients and remove wastes through it surface cell membrane.

A large cell volume demands large surface area but a large cell has a much smaller surface area to volume than smaller cell. Hence the cell membrane of a cell can serve their small volume more easily than the membrane of lager cell.

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Surface Area to Volume Ratio (SA/V):

1. It is the ratio between surface area and volume.
2. Each unit of volume requires a specific amount of surface area to supply its metabolism with raw materials.
3. The amount of surface area available to each unit of volume varies with the size of a cell.
4. As a cell grows its surface area to volume ratio decreases.

**Q26: Explain the process of transport of materials across the plasma membrane.
(BISE Malakand 2018)**

Ans. Cell membrane is being semi-permeable so various substances can move across it.

In this way it maintains the balance of material inside and outside the cell. Materials are move across cell membrane are done by the following ways:

1) Diffusion:

"The random movement of molecules from the region of higher concentration to the region of lower concentration is called diffusion."

1. It is a type of passive transport because it

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does not require energy.

2. Only small molecules can diffused across cell membrane such as water, oxygen and carbon dioxide.
3. Diffusion is slow but efficient and rapid enough to fulfill the requirement of a cell.

Example:

In the small intestine glucose is present in high concentration. It is diffused to villi of small intestine. Then it is stored in liver in the form of glycogen for future use.

2) Facilitate Diffusion:

The movement of molecule from the region of higher concentration to the region of lower concentration through trans-membrane protein is called facilitate diffusion.

Explanation:

Due to size and charge some molecules cannot diffused through cell membrane such molecules are transported through cell membrane by facilitate diffusion.

3) Osmosis (نوس): (BISE Malakand 2018)

The diffusion through semi-permeable membrane is called diffusion.

Types of Osmosis:

There are two types of osmosis:

(i) Exosmosis: (BISE Kohat 2015)

When materials (solvent) moves out from a cell.

(ii) Endosmosis: (BISE Kohat 2015)

When material (solvent) are moves into a cell.

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Examples:

There are few examples that explain how osmosis occurs.

(a) **Hypotonic Solution:** It is a solution which contains high water potential than a cell.

Effects:

When a cell is kept in hypotonic solution the water will move into the cell from surrounding as a result the animal cell swells and may rupture, while the plant cell becomes turgid.

(b) **Isotonic Solution:** (Iso-same, tonic-solution)

It is a solution that contains equal amount of solute to that of a cell.

Effects:

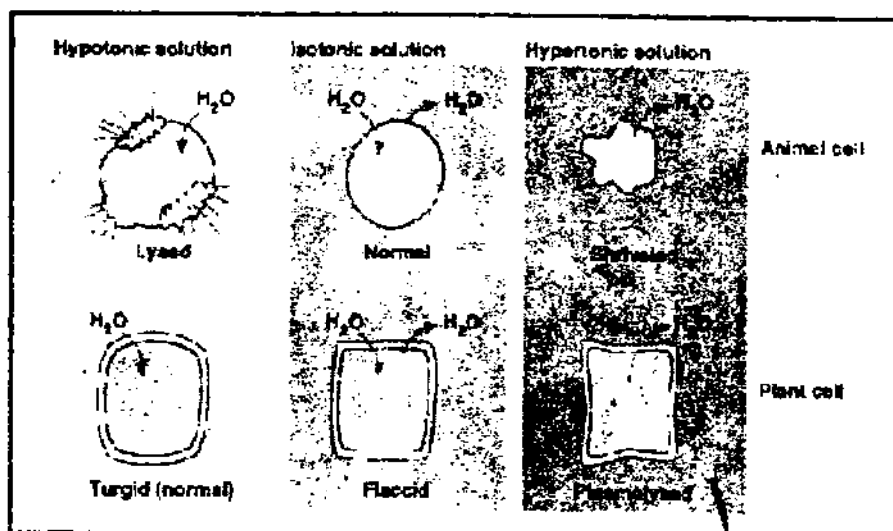
1. When a cell is placed in isotonic solution the rate of osmosis outward is equal to the rate of osmosis inward.
2. In such case animal cells retain their original volume while plant cells become flaccid (loose) because the net uptake of water is not enough.

(c) **Hypertonic Solution:** It is a solution which contains low water potential than the cell.

Effects:

1. When a cell is kept in hypertonic solution water moves out from the cell.
 2. In such cases animal cells shrink in size and in plant cells the cytoplasm shrinks within the cell wall.
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TURGOR:

A cell is said to be turgid when it absorbs water from surrounding.

Explanation:

When a plant cell is kept in hypotonic solution the water moves into the vacuole by osmosis. The vacuole increases in size and pushes the cell contents against the cell wall.

Turgor Pressure:

"The pressure exerted by the cytoplasm against cell wall is called turgor pressure and the phenomena is called turgidity." Plants cell does not burst when it is turgid because the cell wall is strong and relatively inelastic.

Importance of Turgor in Plants:

1. It maintains the shape of plant.
2. It provides support especially to young stem.
3. It helps in opening and closing of stomata.
4. Due to change in turgor some flowers open at

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day time and closed at night.

PLASMOLYSIS:

"The shrinkage of protoplasm due to loss of water by exosmosis is called plasmolysis."

Explanation:

1. When a plant cell is kept in hypertonic solution the water leaves the cell by osmosis.
2. First water leaves from cytoplasm and then from vacuole.
3. Due to outward movement of water from cell the cytoplasm shrinks and pulls away from cell wall. This process is called plasmolysis and the cell is said to be plasmolysed.
4. When a plasmolysed cell is kept again in a hypotonic solution it restores its turgidity. This phenomenon is called deplasmolysis.

ACTIVE TRANSPORT:

The movement of molecules against the concentration gradient i.e. from the lower concentration to higher concentration is called active transport. It uses energy.

Explanation:

For the active transport of substances carrier proteins are present in cell membrane that uses energy and move them from lower concentration to high concentration.

Examples:

Na^+/K^+ are actively transported across the membrane according to the requirement of the cell. i.e.

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in nerve impulse transmission Na is actively transported across nerve cell membrane.

**Q27: Explain exocytosis and endocytosis.
(BISE Kohat)**

Ans. 1) Endocytosis:

"The process in which substances are taken into the cell is called endocytosis."

These substances may be smaller or larger. They may be solid or liquid.

(i) Pinocytosis: Intake of liquid substance.

(ii) Phagocytosis: Intake of solid substance

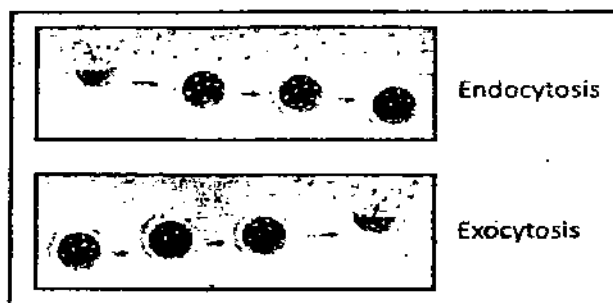
1. In endocytosis the cell membrane folds inwards forming a pocket which takes the material from the environment.
2. This pocket goes deepens forming a vesicle.
3. At last the vesicle separates from cell membrane and moves to inside the cell along with its contents.

2) Exocytosis:

"The process in which material are packed in a vesicle and excreted from a cell is called exocytosis."

Mechanism of Exocytosis:

1. The vesicle in which the material is packed are bind with cell



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membrane.

2. The phospholipid region of two membranes meet which creates an opening to the outside of a cell through which the material are removed from a cell.

Q28: Define filtration.

Ans: Filtration:

"The process in which small molecules are pushed across selectively permeable membrane is called filtration." It is done by hydrostatic or blood pressure.

Example:

Our kidney filters wastes and toxic substance from our blood and removes it from the body.

Q29: Define tissue. Explain different types of plant tissue. (BISE Bannu 2015, Kohat)

Ans: TISSUE: (BISE Abbottabad 2018)

"A group of cell that performs a particular function is called tissue."

Explanation:

1. The cells of the tissue are dependent on each other.
2. There are some organisms where cells grouped together but they do not form tissues because the cells are not dependent but function independently e.g. volvox.

Plant Tissue:

There are two types of plant tissues:

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1. Simple tissue
2. Compound tissue

1) Simple Tissue:

These tissues are composed of only one type of cell and perform specific functions.

Types of Simple Tissue:

There are further two types of simple tissues:

- a. Meristematic or embryonic tissue
- b. Permanent tissue

(a) Meristematic Tissue:

1. These cells have the ability of division.
2. They produce new cells at the growing parts of a plant.

Properties of Meristematic Tissues:

1. Its cell has dense cytoplasm.
2. It has large central nucleus.
3. They have small or no vacuole.
4. Cells are alike with no intracellular spaces.
5. They have thin walls.

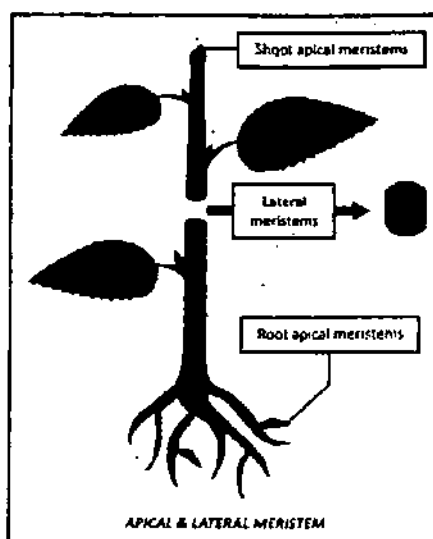
Types of Meristematic Tissues:

There are two types of meristematic tissues:

1. Apical meristem
2. Lateral meristem

1) Apical Mersitem:

1. It is present at the apex of roots and shoots.
2. Here the cells divides and redivides and results in the



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tion of stem and roots causing primary growth.

Primary Growth:

The increase in length or height of an organism is called primary growth.

Lateral Meristem:

It is present in the lateral sides of stem and roots. Here the cells divide and redivide resulting in secondary growth.

Secondary Growth:

The increase in thickness or diameter of an organism is called secondary growth.

2) Permanent Tissues:

"Those tissues whose cells lost the ability of division are called permanent tissues." They are originated from the primary meristem.

Types of Permanent Tissues:

There are three types of this tissue:

- a. Epidermal tissue
- b. Ground tissue
- c. Supporting or mechanical tissue

a) Epidermal Cells:

These tissues are present as outermost protective covering of stem, roots and leaves.

Characteristics:

1. They are flattened and irregular in shape.
 2. They are thick walled.
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3. They are closely packed with no intracellular spaces.

Functions:

1. In leaves it has small pores called stomata which help in exchange of gases.
2. In stem it is thick and contains a waxy layer so prevent transpiration.
3. It forms root hairs which absorb water from soil.

b) Ground Tissues:

These tissues are present in all parts of body except epidermal cell.

Characteristics:

1. They are thin walled.
2. It is made of parenchyma cell.
3. It is oval, spherical or polygonal in shape.

Functions:

1. In leaves it contains chlorophyll so help in photosynthesis.
2. They also store food.

c) Supporting Tissues or Mechanical Tissue:

These tissues provide strength and flexibility to the plant. They are thick walled cells.

Types of Supporting Tissue:

There are two types of supporting tissues:

- i) Collenchyma tissues
- ii) Sclerenchyma tissues

i) Collenchyma Tissues: These are elongated and oval cells. The cells of these tissues are living. It is found in young stem, petiole of lea. and pedicel of

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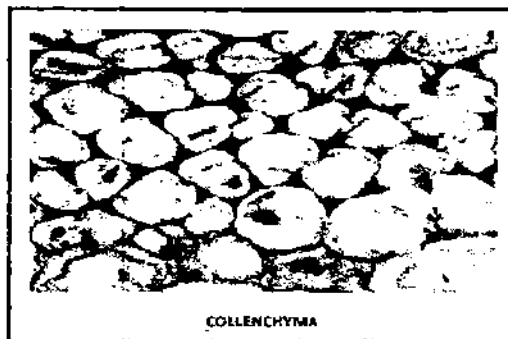
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a flower.

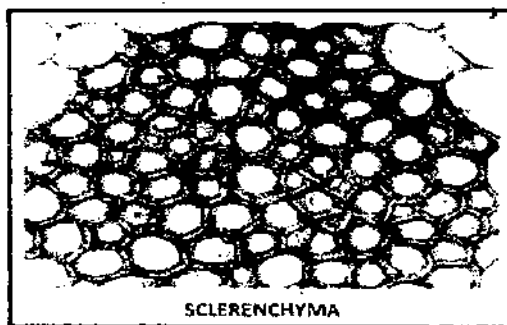
Functions:

1. It provides mechanical support to organs of a plant.
2. In leaves it acts as supporting tissues.



ii) Sclerenchyma Tissues: (Sclerous-hard)

These are thick walled cells. At maturity they lose protoplast and become dead. Their walls are filled with lignin which provides hardness and strength to the cell.



2) Compound Tissues:

These tissues are composed of different types of cells performing a common function. For example;

- i) Xylem
- ii) Phloem

i) XYLEM:

These are plant tissues which are responsible for the transportation of water and dissolved minerals and salts. They transport water and minerals from roots to the upper parts of the plant.

Structure of Xylem:

It is composed of three types of cells:

- a. Vessels

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b. Tracheids

c. Fibers

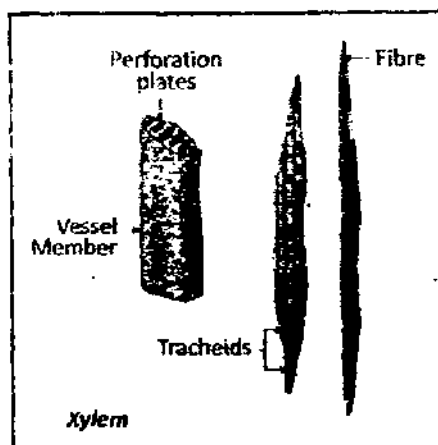
a. Vessels: These are elongated cells specialized for the conduction of water.

1. They are wider and shorter cells.
2. They are connected end to end which form a continuous channel.
3. They become dead at maturity.

b. Tracheid: These are narrow and elongated cells. They have tapered end at both sides.

Pits: These are small pores in xylem which maintain the flow of water.

c. Fibers: These are elongated and thick walled cells with tapering end. Their cell wall contains lignin. They act as supporting tissue.



ii) PHLOEM:

These are plant tissues which are responsible for the transportation of prepared food.

Translocation:

The movement of prepared food in the plant body is called translocation.

Structure:

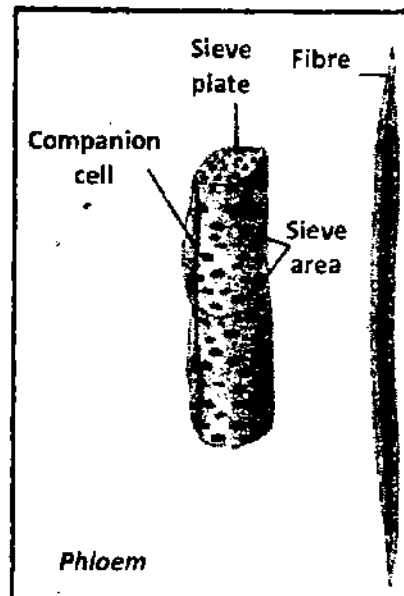
It is composed of two types of cells:

- a. Sieve tube
- b. Companion cell

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a. Sieve Tube: These are elongated living cells which are porous at ends. They are connected to each other through sieve plates. Their protoplasm has no nucleus. It is surrounded by a thick wall of cellulose.

b. Companion Cells: These are elongated thin walled cells around each sieve tube. They contain cytoplasm and nucleus. They regulate the movement of food through sieve tubes.



Q30: Discuss different types of animal tissues.

Ans: Animal Tissue:

On the basis of structure and function animal tissues are classified in four main types:

1. Epithelial tissue
2. Connective tissue
3. Muscular tissue
4. Nervous tissue

1) Epithelial Tissue:

These tissues cover the internal organs and also make internal lining of organs. Skin is made of epithelium which covers the internal organ and separates them from physical environment. These are elongated and flat cells. These also make the internal lining of intestine and lungs.

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2) Connective Tissue:

These tissues connect various parts of the body to each other. It is the major supporting tissue of animal body.

Types of Connective Tissue:

i) Loose Connective Tissues:

1. Its extracellular material contains loosely packed collagen fiber.
2. It holds organs at their specific place.
3. It is widely distributed under epithelial tissues.

ii) Fibrous Connective Tissue:

1. Its extracellular material contains tightly packed collagen.
2. It occurs in the form of tendons and ligaments.

Tendons: It attaches muscle to bone.

Ligament: It attaches bone to bone.

iii) Adipose Tissue:

1. It contains swollen cells because it contains large number of fats droplets.
2. It provides energy and insulates organs against heat loss.
3. It protects and support organs.
4. It is present under the skin and around kidneys.

iv) Cartilage:

1. Its extracellular material contains a bundle of collagen fibers and rubbery substance.
 2. It is present at the end of bones, external ear, nose, trachea and larynx.
 3. It provides support and maintains shape.
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v) Bone:

1. It is a hard structure which makes endoskeleton.
2. Its extracellular material contains collagen fiber and calcium salt.
3. It supports, protects, provide lever system for movement, stores calcium and forms blood cells.

vi) Blood:

1. It is a special type of connective tissue.
2. Its extracellular material is plasma, which is a fluid.
3. It transports nutrients and gases in the body.
4. It also helps to fight against germs.

3) Muscular Tissue:

These tissues have the ability of contraction and relaxation. It is composed of elongated cells which are contractile in nature.

Types of Muscles:

There are three types of muscles:

- i) Skeletal muscle
- ii) Smooth muscle
- iii) Cardiac muscle

i) Skeletal Muscle:

1. These muscles are found on external body surface.
2. They are attaches to bones and cartilage by tendons.

Properties:

1. They are long and cylindrical.
 2. They have striation (light and dark bands when seen under microscope).
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3. They are voluntary in action.
4. They are multi-nucleated.
5. It helps in movement.

Examples: bicep and tricep.

ii) Smooth Muscle:

The muscles are found in the walls of hollow organs
i.e. blood vessel, intestine and stomach etc.

Properties:

1. They are involuntary.
2. They do not get fatigue easily.
3. They are spindle in shape.
4. They have no striation.
5. They contract slowly.

iii) Cardiac Muscle (Card-Heart):

These muscles are only found in heart.

Properties:

1. They are involuntary in action.
2. They have striation.
3. They do not get fatigue.
4. They are branched shaped e.g. myocardium.

4) Nervous Tissue:

These tissues are responsible for the conduction of messages in the body. It contains neurons which carry informational signals in the body. It is present in brain, spinal cord and other parts of body.

EXERCISE

A. Encircle the best suitable answers.

1. Schleiden and Schwann proposed the cell theory on the basis of:
✓ (a) Their observation
(b) Observation of Hooke and Brown
(c) All observation on the cell.
(d) Observation made on the nucleus of the cell
 2. The organelle which provides energy to the cell:
(a) Golgi apparatus (b) Ribosome
✓ (c) Mitochondria (d) Nucleus
 3. We obtain 2D images through:
(a) Light microscope and SEM
(b) SEM and TEM
✓ (c) Light microscope and TEM
(d) Light microscope
 4. Inside the nucleus, granular material is called:
(a) Cytoplasm (b) Protoplasm
✓ (c) Nucleoplasm (d) Cell sap
 5. The organelle involved in protein synthesis is:
✓ (a) Ribosome (b) Vacuole
(c) Golgi apparatus (d) Plastids
 6. The nervous tissue has the ability to:
(a) Contract and relax
✓ (b) Transmit the impulses
(c) Prepare secretion
(d) Provide energy
-

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7. In plants, which tissue makes new cells?
✓ (a) Meristematic tissue
(b) Collenchyma tissue
(c) Epidermal tissue
(d) Ground tissue
8. Movement of molecules from lower to higher concentration with the expenditure of energy is:
(a) Diffusion ✓ (b) Active transport
(c) Facilitated transport (d) Osmosis
9. One of the following has both cytoplasm and cell wall:
(a) Muscle cell (b) Red blood cell
✓ (c) Root hair cell (d) Xylem vessel
10. Cell membrane is made of:
(a) Cellulose only
(b) Lipids only
(c) Lipids only
✓ (d) Lipids and proteins
11. Cell wall is present in the cells of:
(a) Fungi only (b) Plants only
(c) Plants and prokaryotes only
✓ (d) All of the above
12. Which organelles are covered with a double membrane?
(a) Ribosomes
(b) Vacuoles
(c) Centrioles
✓ (d) Mitochondria
-

Short Questions

B. Write short answers for the following questions:

Q1: What proposed the cell theory and what are the main points of the cell theory?

Ans. Cell theory was proposed by two scientists named Schleiden and Schwann.

Main Points:

1. All living organisms are made of cells.
2. Cell is the basic unit of structure and function of living organisms.
3. All metabolic process occurs in a cell.
4. Cell contains heredity material which passes characters from parents to offspring.
5. New cells are arised from old cells.

Q2: Differentiate between simple and compound tissue. (BISE Swat 2017)

Ans.

Simple Tissue	Compound Tissue
1. Also called embryonic tissue.	Also called permanent tissue.
2. It is made of one type of cell.	It is made of different types of cell.
3. It has the ability of division.	They lack the ability of division.
4. They are concerned with primary and sec-	They acts as supporting tissue and provides

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ondary growth of plant. e.g. epidermal tissue	strength to plant. e.g. xylem, phloem
--	--

Q3: How cell membrane helps in maintain equilibrium while exchanging materials with environment?

Ans: Cell membrane covers the surrounded by each and every cell. It is being selectively permeable so allow the movement of some molecules.

1. It absorbs nutrients from surrounding if needed.
2. It eliminates extra water and waste material from the cell.
3. By performing the above process cell membrane maintains the equilibrium of materials inside the cell.

Q4: Differentiate between endocytosis and exocytosis? (BISE Malakand 2018)

Ans:

Endocytosis	Exocytosis
1. In this process substances are taken into the cell.	In this process substances are removed from cell.
2. In this the material form a packet in cell membrane when enters.	Here the material is packed in a vesicle when removed.

Q5: How does turgor pressure develops in a plant cell?

Ans: Turgor Pressure:

1. It is the pressure exerted by cytoplasm against

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cell wall.

2. When a plant is surrounded by water, the water moves into the cytoplasm and then to vacuole.
3. When vacuole takes water it increases in size which pushes the cytoplasmic content to put pressure on cell wall, so a pressure is developed called turgor pressure.

Long Questions

C. Write detailed answers for the following questions:

Q1: Root hairs are adapted to absorption and xylem to support. Relate the functions to their structure.

Ans. Root Hairs:

1. These are small hair like structure arises from roots.
2. For the absorption of water it increases the surface area of roots.
3. They spread in soil and reaches to water table of earth.
4. They are also thin walled.
5. So the root hairs are designed for the absorption of water and dissolved minerals.

Xylem:

1. Xylem conducts water in plant body. It also gives support to plants.
2. The cells of xylem are placed on the top of

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each other such that it forms a long tube in middle of stem and branches. This design helps them to conduct water and provide support.

Q2: Discuss different types of tissues in plants. Elaborate your answer with relevant diagrams.

Ans: Please see Question number...

Q3: Describe the nervous, muscular and epithelial tissues.

Ans: Please see Question number...

Q4: Write a note on the structure of cell wall, cell membrane, mitochondria and chloroplast of a plant cell.

Ans: Please see Question number...



- ✿ محنت اتنی خاموشی سے کرو کہ تمہاری کامیابی شور مچا دے۔
- ✿ محنتی شخص کے سامنے پہاڑ نکھر ہے اور کامل انسان کے سامنے نکھر پہاڑ ہے۔
- ✿ اگر آدمی کی نیت درست ہو اور وہ کوشش شروع کر دے تو اللہ تعالیٰ کی مدد آجایا کرتی ہے۔
- ✿ جن کا بھروسہ اللہ تعالیٰ ہو، ان کی منزل کامیابی ہے۔
- ✿ اللہ تعالیٰ کی رحمت کی پہلی نشانی یہ ہے کہ انسان کو اپنے عیب نظر آنے شروع ہو جاتے ہیں۔
- ✿ جب زمانہ مشکل میں ڈال دیتا ہے تو میرا رب ہزار راستے کھول دیتا ہے۔
- ✿ آنکھ کی توبہ حرام چیزیں نہ دیکھنے میں ہے۔

CELL CYCLE

Q1: Define cell cycle. Discuss its phases.

غلوی چکر کیا ہے؟ اس کے مراحل لکھیں۔

(BISE Bannu 2014, Abtd 2015, Pesh, 2016, Kohat 2017, Mkd 2018, Mdn)

Ans. Cell Cycle:

"The time from the beginning of one cell division to the beginning of next cell division is called cell cycle."

Explanation:

Cell cycle is a series of events in which the cell grows in size, its DNA replicates and various enzymes are formed.

Phases of Cell Cycle:

Cell cycle is completed in two main phases:

1. Interphase
2. Division phase (mitosis and meiosis)

1) Interphase: (Resting Stage)

1. It is the longest phase of cell cycle.
2. It is the gap of period between the end of one cell division and the start of next cell division.
3. In this phase the cell prepare itself for division.

Sub-Phases of Interphase:

Interphase is sub-divided into three phases:

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i) *G1 phase*

ii) *S-phase*

iii) *G2 phase*

i) **G1 Phase (G-Gap):**

1. *It is the first sub-phase of interphase.*
2. *It is the longest phase.*

Events:

1. *Cell grows in size.*
2. *Internal chemical changes in a cell.*
3. *Preparation of DNA replication.*
4. *Synthesis of ribosome and RNA.*
5. *Synthesis of several enzymes.*
6. *Duration: from few hours to days.*

ii) **S-Phase (S-synthesis):**

It is the second sub-phase of interphase.

Events:

1. *Replication of DNA occurs.*
2. *Attachment of protein to DNA for the formation of chromosome.*
3. *Chromosome is formed which consists of two sister chromatids.*
4. *Growth of cell is continuous.*
5. *Synthesis of proteins and several enzymes for DNA replication.*

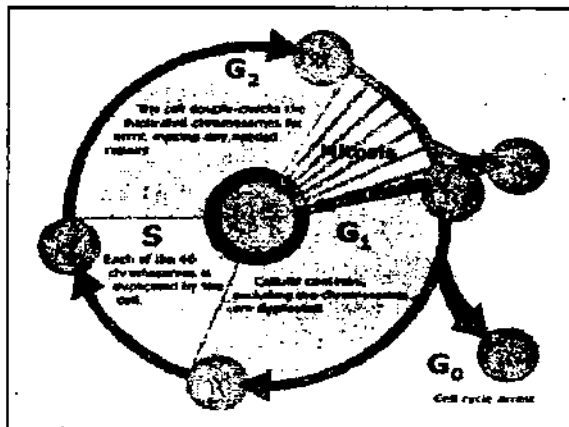
iii) **G2 Phase:**

It is the period between the completion of DNA synthesis and beginning of active cell division.

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Events:

1. Cell prepares protein required for cell division.
2. Replication of centriole and their movement to opposite poles.
3. Formation of aster takes place. At this stage the cell has double number of chromosomes.



Q2: Define mitosis. Discuss its various phases. (BISE Pesh 2016)

Ans. Mitosis: (BISE Abbottabad 2018)

A type of cell division in which the number of chromosomes remains constant. (OR)

A type of cell division in which the daughter cell receives same number of chromosomes as parent cell. The process of mitosis was studied by a German biologist Walther Fleming.

Phases of Mitosis:

Mitosis is mainly divided into two phases:

1. Karyokinesis
2. Cytokinesis

1) Karyokinesis: (Karyon-nucleus, kinesis-division)

The division of nucleus is called karyokinesis.

Phases of Karyokinesis:

Karyokinesis is complete in four steps or phases:

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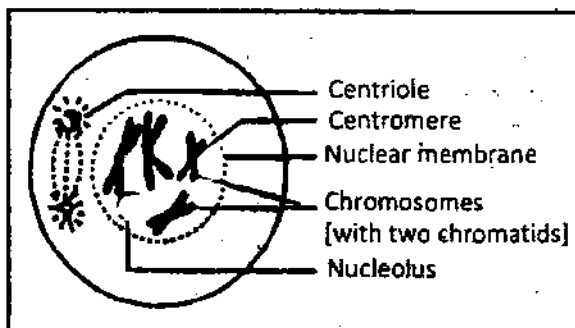
- i) Prophase
- ii) Metaphases
- iii) Anaphase
- iv) Telophase

i) Prophase: (Pro-before, phases-appearance)

It is the first sub-phase of karyokinesis.

Events:

1. Formation of chromosomes by the coiling and condensation of chromatin.
2. Each chromosome is composed two sister chromatid.
3. Chromosome becomes thick and become visible.
4. Nuclear membrane splits and disappears.
5. Nucleolus also disappears.
6. Centriole divides and moves to opposite poles.



Mitotic Apparatus:

It is a network of spindle fibers between two poles which is made by centrioles.

Mitotic Apparatus in Animal Cell:

In animals it is formed by two pairs of centriole.

Mitotic Apparatus in Plant Cell:

In plant cell mitotic spindle is formed by the aggregation of spindle fibers present in cytoplasm because there is no centriole in plant cell.

ii) Metaphase:

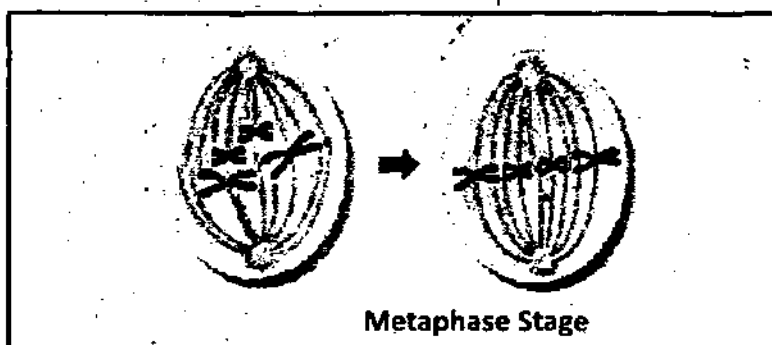
It is the second phase of karyokinesis.

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Events:

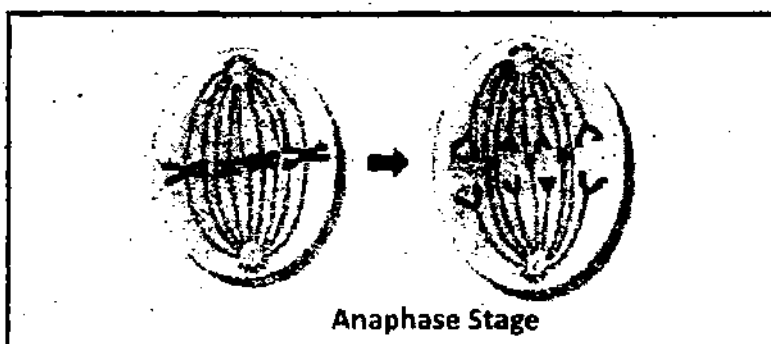
1. Chromosome becomes short and thick.
2. Spindle fiber attached to centromere.
3. Chromosome arranges themselves at the equator of the cell called equatorial or metaphase plate.



iii) Anaphase:

Events:

1. The spindle fibers pull the chromatids to opposite poles.
2. The centromere of each chromosome splits.
3. The separated chromatids are called daughter chromosomes.



iv) Telophase:

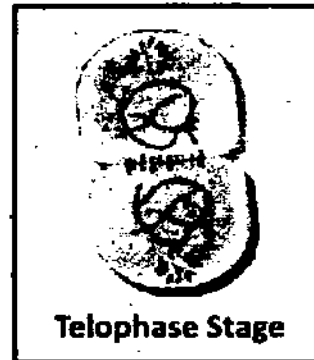
It is last phase of karyokinesis. It is the reverse

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phase of prophase.

Events:

1. Uncoiling of chromosome takes place.
2. Nuclear membrane reappears.
3. Nucleolus reappears.
4. So two daughter nuclei are formed.



2) Cytokinesis: (Cyto-cytoplasm, kinesis-division)

"The division of cytoplasm is called cytokinesis." In this a groove appears just between the two nuclei. This groove goes deepens and deepens and at last it divides the cell into two daughter cells.

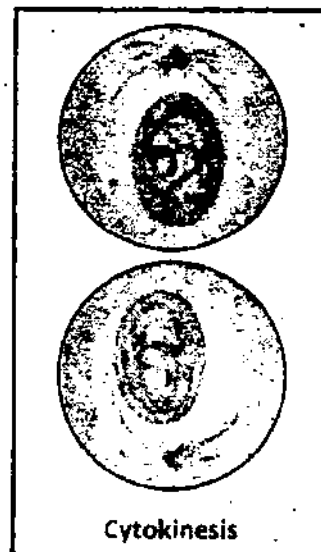
Q3: What is the difference between cytokinesis of animal and plant cell?

Ans. Cytokinesis in Animal Cells:

In animals the cell membrane folded inward forming a groove which grows deeps and finally separates the two nuclei/cells.

Cytokinesis in Plant Cell:

In plant cell a cell plate is formed between two daughter nuclei which divides the cell into two. The golgi bodies produces a fluid filled vesicle which fuses and form cell plate.



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Q4: Write significance of mitosis.

Ans. Significance of Mitosis:

1) Growth:

New cells are produced due to mitosis that helps in growth of the body.

2) Repair or Healing of Wounds:

Healing of wound is due to mitosis. It removes dead cells and form new cells.

3) Asexual Reproduction:

Various animals (hydra) reproduce asexually by mitosis. A sexual reproduction in plants also, takes place by mitosis.

4) Regeneration:

Regeneration of cutted parts in some organism is also due to mitosis e.g. lizard tail.

5) Growth of hairs and nails is due to mitosis.

Q5: What is meiosis? Explain its stages.

Ans. Meiosis:

A type of cell division in which the daughter cell receives half number of chromosome as compare to parent cell. (OR)

A type of cell division in which the number of chromosomes become half.

Explanation:

In meiosis one diploid cell is converted into four haploid cells. It takes place during the formation of

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gametes or sex cells i.e. sperm and ova. It occurs in germ (sex) cells.

Stages of Meiosis:

Meiosis is divided into two stages:

1. Meiosis I
2. Meiosis II

1) MEIOSIS-I:

In this the daughter cell receives half number of chromosomes after division. It completes in the following stages:

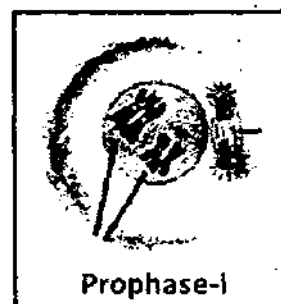
- i) Prophase-I
- ii) Metaphase-I
- iii) Anaphase-I
- iv) Telophase-I

i) Prophase-I:

1. It is the longest phase.
2. About 90% of the total time spent in this phase.

Homologous chromosomes:

The chromosomes which are equal in size, length and shape.



Events:

1. Chromatin condenses to form chromosome.
2. Chromosomes become visible.
3. Pairing of homologous chromosome takes place called synapses.
4. Crossing over takes place after synapses in

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which various segments of chromosomes exchanged.

5. Then the two non-sister chromatid of homologous chromosomes unzipped together forming chiasmata.
6. Nuclear membrane also splits and disappears.
7. Centriole migrates to opposite pole and makes spindle fibers.

ii) Metaphase-I:

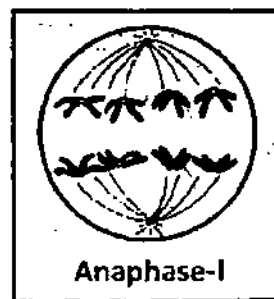
Events:

1. Homologous chromosomes arranged themselves in a plate called metaphase plate.
2. Attachment of spindle fibers to each homologous chromosome.



iii) Anaphase-I:

1. Spindle fibers pull the homologous chromosome towards poles.
2. The paired chromosome is now separated from each other and moves to opposite poles.
3. Sister chromatids are remain attached.
4. In this way one haploid set of chromosome is formed at each pole.



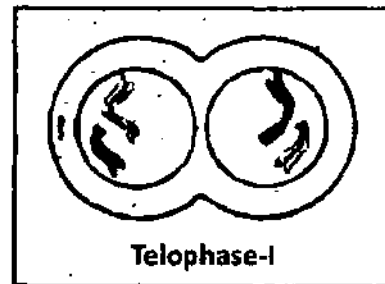
iv) Telophase-I:

1. Chromosome reached to their respective poles.

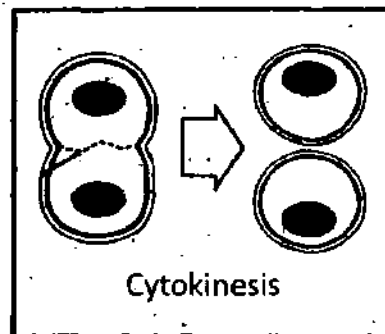
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2. Nucleolus becomes reappear.
3. Nuclear membrane forms again.
4. Spindle fiber degenerates.
5. Two daughter haploid nuclei are formed.



Later on by cytokinesis the two nuclei are divided and form two daughter cells with haploid number of chromosome.



2) MEIOSIS-II:

It is the process just like mitosis. However it is different from mitosis because in this parent cell have haploid number of chromosome and the daughter cell also receives half number of chromosomes. The cells which are formed in meiosis, now it undergoes meiosis-II.

Phases of Meiosis-II:

Meiosis contains the following phases:

- i) Prophase-II
- ii) Metaphase-II
- iii) Anaphase-II
- iv) Telophase-II

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i) Prophase-II:

1. Chromosomes become visible.
2. Each chromosome contains two chromatids and centromere.
3. Nucleoli disappear.
4. Nuclear membrane disappears.
5. Centrioles move to opposite pole.
6. Formation of spindle fiber takes place.

ii) Metaphase-II:

1. Spindle fibers attached to chromosome.
2. Chromosomes arrange themselves in equator and form equatorial plate.

iii) Anaphase-II:

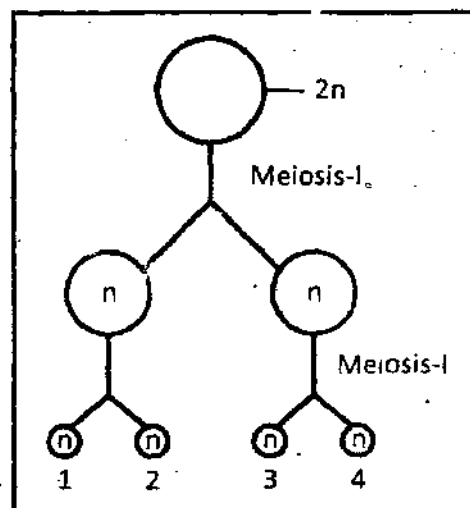
1. Contraction of spindle fiber takes place.
2. This contraction pulls the chromosomes to opposite poles.

iv) Telophase-II:

1. Sister chromatids of each chromosome move to opposite poles.
2. Nucleoli become reappear.
3. Nuclear membranes are formed again.
4. Two daughter nuclei are formed.

Cytokinesis:

The cytoplasm is divided resulting in the formation of two daughter cells. Hence in meiosis 4



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daughter cells are formed i.e. 2 cells are formed in meiosis-I and 2 cells are formed in meiosis-II.

Q6: What is the significance of meiosis?

Ans. Significance of Meiosis: (BISE Kohat 2017)

1. It serves to maintain the number of chromosomes constant in organism.
2. It helps in the formation of gametes.
3. It is responsible for sexual reproduction.
4. Due to meiosis new varieties are formed of organisms.
5. It helps to transfer the character from parents to offsprings.
6. It leads to evolution.

Q7: Define cell death. Write its types.

Ans. Cell Death: (BISE Swat 2017)

"When a cell is unable to perform its function is called cell death."

Types of Cell Death:

There are two types of cell death:

1. Apoptosis
2. Necrosis

1) Apoptosis:

It is also called programmed cell death. In this the cell dies naturally and automatically.

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Explanation:

In apoptosis the contents of the cell does not release outside. There is no inflammation occurs. It is a normal process and is necessary event of development.

Examples:

- 1. During metamorphosis the tail of tadpole disappears.*
- 2. During development the web present between the fingers disappears.*
- 3. In adult organism the number of cells is kept relatively constant through apoptosis and division.*

2) Necrosis:

"The death of a cell due to a disease or injury is called necrosis."

Explanation:

In this the cell dies accidentally due to a disease or damage of tissue.

Examples:

- 1. When a cell is exposed to toxins or physical events like radiation, burns, lack of oxygen and trauma etc it dies.*
 - 2. Inflammation occurs.*
 - 3. Swelling occurs due to the release of content to surrounding environment.*
-

EXERCISE

A. Encircle the best suitable answers.

1. All of the following true for meiosis, except:
(a) There is no DNA synthesis between the divisions
(b) The result is four cells with haploid number of chromosomes
✓ (c) Meiosis does not contribute to the genetic diversity in populations
(d) Fusion of two products of meiosis produces a zygote
2. If $2n = 8$, for a particular cell, then the chromosome number in egg cell after meiosis would be:
(a) 12 (b) 10
(c) 8 ✓ (d) 4
3. During which stage of meiosis do the chromosomes have the least amount of DNA?
(a) Prophase-I (b) Prophase-II
(c) Telophase-I ✓ (d) Telophase-II
4. Which statement concerning both mitosis and meiosis is correct?
✓ (a) Meiosis produces 4 haploid cells while mitosis produces 2 diploid cells
(b) Meiosis produces 4 diploid cells while mitosis produces 2 haploid cells
(c) Meiosis maintains the number of chromosomes, while mitosis reduces it
(d) Prophase-I of mitosis results in the forma-

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tion of a tetrad but not in prophase-I of meiosis-I.

5. During which phase of meiosis, crossing over occurs?
- ✓ (a) Prophase-I (b) Metaphase-I
(c) Metaphase-II (d) Anaphase-I
6. Which of the following occurs during meiosis-I but not during mitosis?
- (a) The chromatids of each chromosome are separated
✓ (b) Synapsis and crossing-over occurs
(c) The nuclear envelope breaks down
7. Meiosis takes place in which of the following organs?
- ✓ (a) Testes (b) Lungs
(c) Heart (d) Stomach
8. Two sister chromatids are collectively called:
- ✓ (a) Chromosome (b) Centromere
(c) Multichromatid (d) Homologous pair
9. During the process of regeneration, the type of cell division is:
- (a) Only 1st meiotic division
(b) Both meiotic divisions
✓ (c) Mitosis (d) All of them
10. Which of the following statements are true about homologous chromosomes?
- (a) They are identical
(b) They pair-up during meiosis
(c) One partner of homologous pair move to each daughter cell
✓ (d) All of them
-

Short Questions

B. Write short answers for the following questions:

Q1: Define cell cycle and in how many phases it is divided?

Ans: "The time from the beginning of one cell division to the beginning of next cell division is called cell cycle."

Phases of Cell Cycle:

It is divided into two main phases:

1. Interphase
2. Division phase

1) Interphase:

It is further divided into three sub-phases:

- a. G1 phase
- b. S-phase
- c. G2 phase

2) Division Phase:

It is divided into karyokinesis and cytokinesis.

Karyokinesis:

It is further divided into four phases:

- a. Prophase
- b. Metaphase
- c. Anaphase
- d. Telophase

Q2: In which type of cells, meiosis take place and why it is important?

Ans: Meiosis takes place in germ cells of the body.

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Importance:

1. It maintains the constant number of chromosomes in organism.
2. It leads to the formation of new varieties.
3. Sexual reproduction is due to meiosis.
4. It helps to form gametes.
5. It leads to evolution.

Q3: How does normal mitosis ensure normal life?

Ans. Normal mitosis ensures normal life by the following ways:

1. Normal growth of the body occurs due to mitosis.
2. Due to mitosis infected or abnormal cell is replaced by new cells.
3. Mitosis results to maintain constant number of chromosomes in body cells.
4. Due to mitosis new cells are formed that helps in growth of the body.
5. Due to mitosis genetic material are equally transmitted to daughter cells.

Q4: Give at least four differences between mitosis and meiosis.

Ans. (BISE Peshawar, Malakand 2016, Kohat. 2017)

Mitosis	Meiosis
1. It occurs in body cells.	It occurs in germ cells.
2. It produces two daughter cells.	It produces four daughter cells.
3. In mitosis the numbers of chromosomes remain constant in	In meiosis the numbers of chromosomes reduce in daughter cells.

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daughter cells.	
4. Daughter cells are exactly alike.	Daughter cells may differ from parent.
5. It involves only single division of cell.	It involves two consecutive divisions of cell.

Q5: What is chiasma and what is its role in crossing over?

Ans: Chiasma:

It is a point through which the non-sister chromatids are physically connected.

Role in Crossing Over:

At the point of chiasma the two non-sister homologous chromosomes exchange genetic materials which leads to the formation of new varieties.

Long Questions

C. Write detailed answers for the following questions:

Q1: Describe various phases of interphase of cell cycle with diagrams.

Ans: Please see Question number 1.

Q2: Discuss different events of meiosis-I with the help of diagrams.

Ans: Please see Question number 5.

Q3: Explain different stages of mitosis with diagrams and at what stage cytokinesis takes place?

Ans: Please see Question number 2.



CHAPTER

6

ENZYME

Q1: What is enzyme? Define substrate and product.

Ans: Enzyme: (En-inside, zyme-yeast)
(BISE Malakand 2019)

Enzymes are biochemical catalyst which regulates (accelerate) the rate of reaction inside the body.

Discovery of Enzyme:

The term "enzyme" was first used by a German physiologist Winhelum Kuhne in 1878.

Enzymology:

The study of enzyme is called enzymology.

Substrate:

"Any substance on which enzyme acts is called substrate."

Product:

"Those substances which are produced in result of enzyme action are called products."

Q2: What is metabolism?

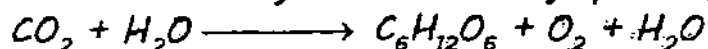
Ans: Metabolism:

"The sum of all chemical reactions that takes place in a living body is called metabolism." It is consists of anabolism and catabolism.

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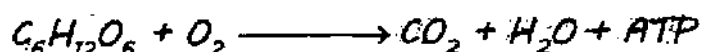
Anabolism:

It is a constructive process in which small molecules combine to form large molecules. e.g. photosynthesis.



Catabolism:

It is a destructive process in which large molecules are broken down to smaller molecules. e.g. respiration.



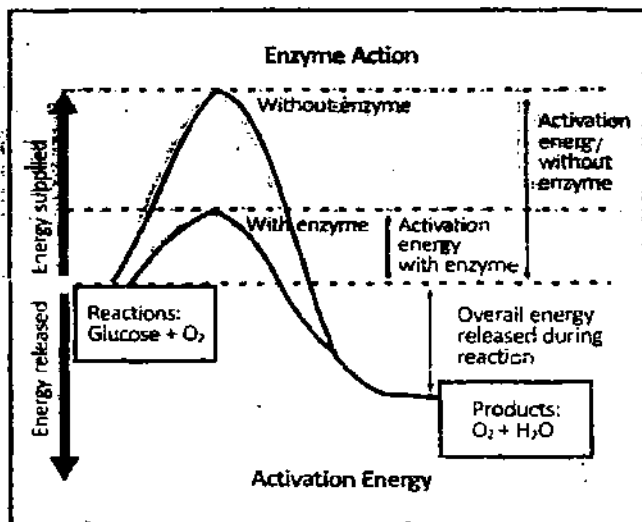
Q3: How enzymes lower the activation energy?

Ans: Activation Energy (E_A):

"The minimum amount of energy requires to start a reaction is called activation energy."

Explanation:

Whenever a chemical reaction takes place some amount of energy is spent to break the bond and convert the reactants into products, this energy is called activation energy. Enzymes can lower the activation energy by the following ways:



1. By changing the shape of substrate
2. By disrupting the charge distribution on sub-

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strate molecule

3. By lowering the activation energy enzymes can speed up the rate of reaction.

Q4: What are the characteristics of enzyme?
(BISE Mardan 2015, Malakand, Peshawar 2016)

Ans: Characteristics of Enzyme:

1) Proteinous Nature:

Enzymes are made of proteins.

2) Remain Unaffected:

Enzymes remain constant after the completion of reaction.

3) Specific in Action:

Enzymes are specific in action. One enzyme can catalyze only one reaction.

4) Used in Small Amount:

Enzymes are required in very small amount.

5) Increase the Rate of Reaction:

Enzyme can speed up the rate of reaction many times.

6) Lower the Activation Energy:

Enzyme can lower the activation energy.

7) Sensitivity:

Enzymes are sensitive to change in temperature, pH and concentration of substrate.

8) Synthesis:

All enzymes are synthesis within a cell.

i) Extracellular Enzyme:

These enzymes work outside the cell e.g. pepsin in stomach.

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ii) Intracellular Enzyme:

These enzymes act inside the cell e.g. mitochondrial enzyme.

9) Active Site:

It is a specific site in enzyme to which substrates binds.

10) Need of Cofactor:

The non-proteinous part of an enzyme is called co-factor. It is required by enzyme for proper working.

Types of Cofactor:

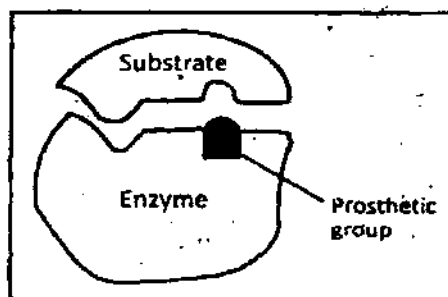
There are three types of cofactor:

i) Prosthetic Group:

The non-proteinous organic molecules which are covalently bonded to enzyme e.g. heme (hemoglobin).

ii) Co-Enzymes:

It is the non-proteinous part which is loosely attached to enzymes. It is essential for the functioning of enzyme e.g. NAD, FAD, NADP.



iii) Activators:

The non-proteinous inorganic ion which works as a cofactor is called cofactor e.g. metal ions such as Mg^{+2} , Fe^{+2} and K^+ etc.

Q5: Explain enzyme specificity.

(BISE Malakand 2014, Bannu, Abbottabad 2015)

Ans. Enzyme Specificity:

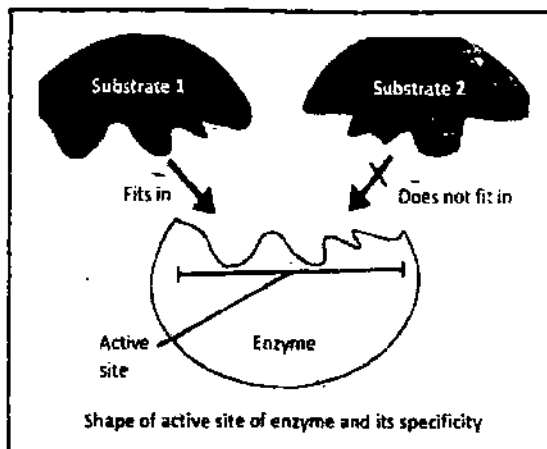
1. It means that each enzyme is specific for their

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function.

2. Every enzyme catalyzes only a particular substrate.

3. The specificity of an enzyme is due to the shape of their active site.



4. The active site of each enzyme have specific shape that fits to substrate.

Examples:

1. Proteases: It digests only proteins.
2. Amylase: It digests only starch.
3. Cellulose: It speeds up the digestion of cellulose.

Q6: Explain the mechanism of enzyme action.

Ans. Enzyme contains a small pocket called active site. To this active site substrate molecule is attached form enzyme-substrate complex.



After Es complex the catalysis of substrate occurs.

Models about Enzyme Action:

There are two models about enzyme action:

1. Lock and key model
2. Induced fit model

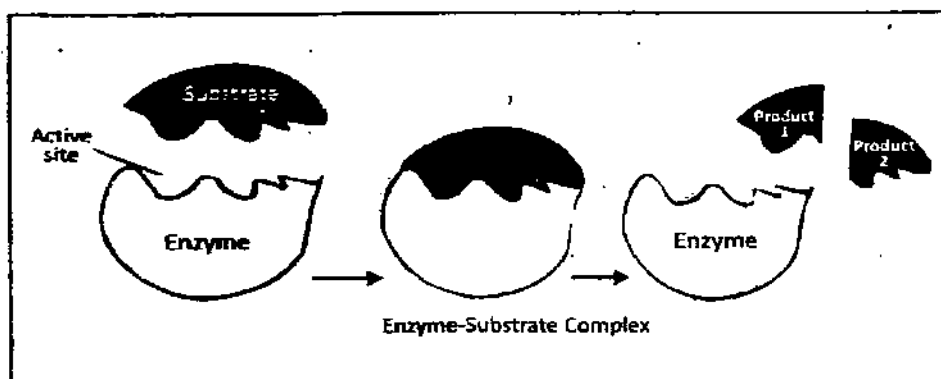
1) Lock and Key Model:

This model was proposed by a German chemist Emil Fisher in 1894.

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Statement:

Enzymes and substrates work like a lock and key as specific key can open a specific lock. Similarly a specific enzyme can catalyze a specific substrate. This model suggested that active site is rigid and non-flexible.

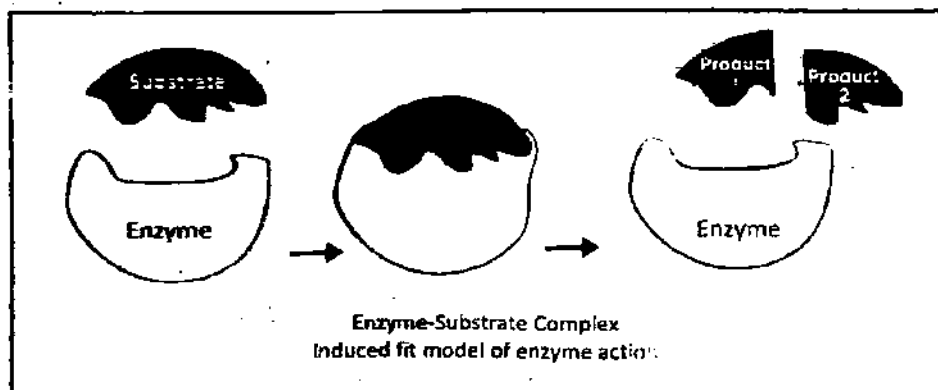


2) Induce Fit Model:

This model was proposed by Koshland in 1958.

Statement:

According to this model the enzyme does not retain its original shape and structure of active site but the contact of substrate induces geometrical changes in active site of enzyme. So the enzyme molecule is made to fit the configuration of the substrate.

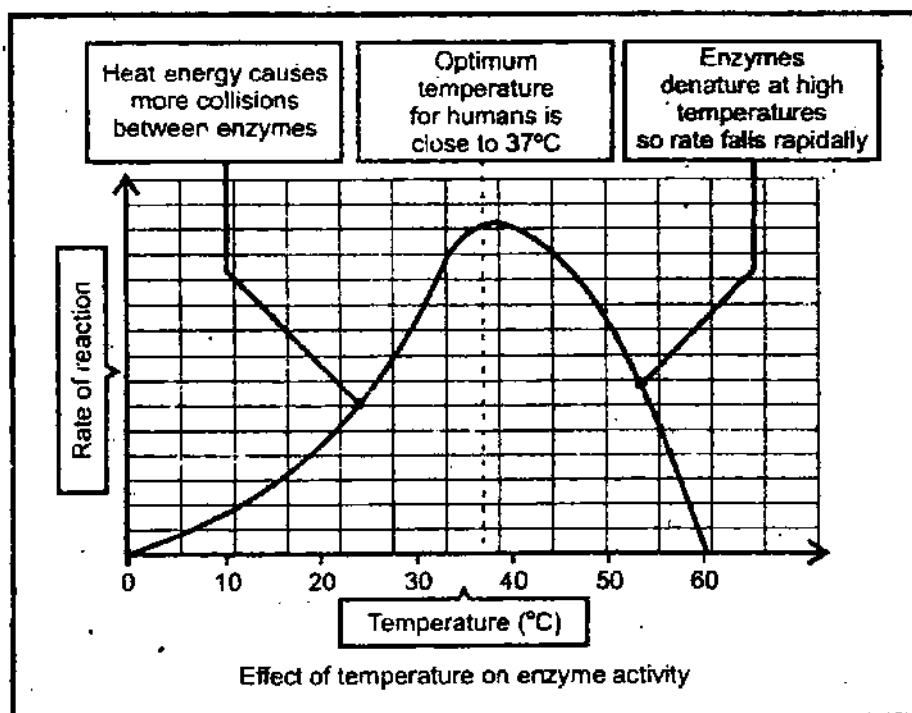


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Factors that affect rate of enzyme action are following:

1. Temperature
2. pH
3. concentration of substrate



1) Effect of Temperature:

Temperature has a direct relation with rate of enzyme action.

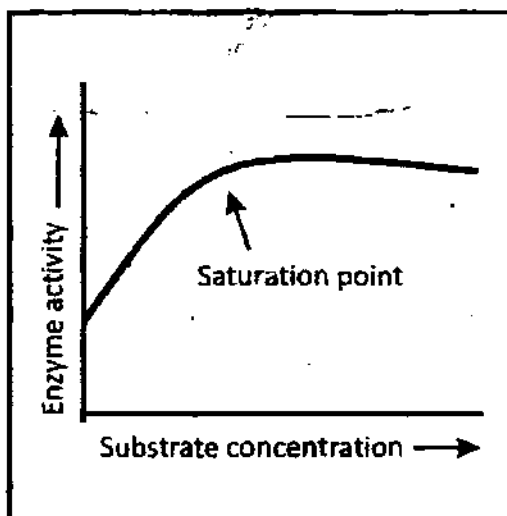
1. Increase in temperature increase the rate of enzyme action because heating promotes molecular action.
2. But very high temperature stops the activity of enzyme by denaturing them.
3. Average temperature for human enzyme is 37°C.
4. Human enzymes start denaturing at 40°C.

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2) Effect of pH:

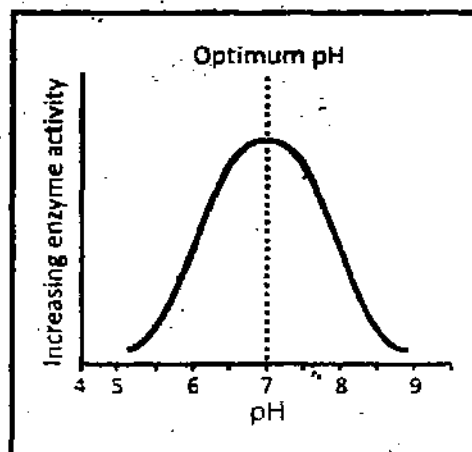
1. Every enzyme works in a particular range of pH.
2. At optimum pH enzyme works best.
3. If the pH is change for a particular enzyme, it will not work properly.

e.g. Enzyme	pH
Pepsin:	2.0
Lipase:	4-5
Trypsin:	7.8-8.7



3) Effect of Substrate Concentration:

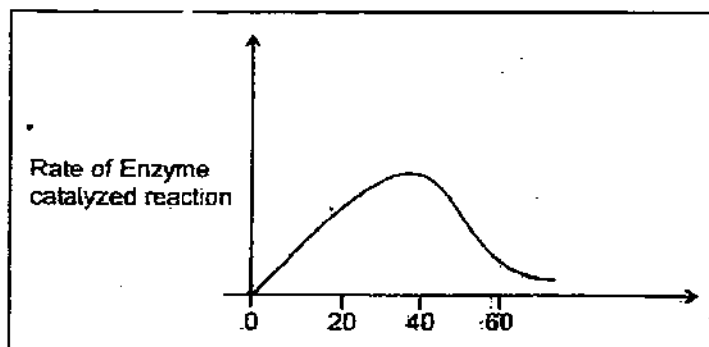
Increase in substrate concentration can increase the rate of reaction because more substrates molecule can collide with enzyme. Hence more reactions will take place. But very high concentration of substrate will lower the reaction because there will be no free active site for the remaining substrate.



EXERCISE

A. Encircle the best suitable answers.

1. The chemicals which are involved as catalysts inside the living bodies are:
(a) Carbohydrates (b) Fats
✓ (c) Proteins (d) Starch
2. Enzymes are biological catalysts which:
(a) Allow new chemical reactions to occur
(b) Are used up during chemical reactions
(c) Alter the direction of chemical reactions
✓ (d) Alter the rate of chemical reactions
3. The graph below shows that the rate of an enzyme catalyzed reaction, its rate:



- (a) Increases when the temperature is increased
 - (b) Decreases when the temperature is decreased
 - ✓ (c) Increases with temperature upto a maximum of 40°C
 - (d) Remain unchanged
4. What is true about enzymes?
(a) All parts of enzyme molecule take part in reaction

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- ✓ (b) Enzymes lower the activation energy of reaction
 - (c) An enzyme can act upon any kind of substrates
 - (d) They are needed in large quantities
 - 5. What is true about cofactors?
 - (a) take part in reactions
 - ✓ (b) Help enzymes in their activity
 - (c) Increase activation energy
 - (d) Are composed of proteins
 - 6. One of the following may function as coenzymes for the enzymes:
 - (a) Proteins
 - (b) Carbohydrates
 - ✓ (c) Vitamins
 - (d) DNA
 - 7. Increase or decrease in temperature beyond the optimum temperature will:
 - (a) Increase the rate of reaction
 - ✓ (b) Decrease the rate of reaction
 - (c) Not affect the rate of reaction
 - (d) Denature the enzyme
 - 8. Trypsin, an enzymes, works at:
 - ✓ (a) Alkaline pH
 - (b) Acidic pH
 - (c) Neutral pH
 - (d) pH does not affect its activity
 - 9. Change in environmental facts will affect enzymes activity and therefore, may affect:
 - (a) Metabolism
 - (b) Respiration
 - (c) Digestion
 - ✓ (d) All of them
 - 10. The body temperature at 104°F is known as critical because it causes:
-

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- (a) Nerves breakdown
- (b) Boiling of body water
- ✓ (c) Enzymes stop to work
- (d) None of them

Short Questions

B. Write short answers for the following questions:

Q1: Differentiate between lock and key model and induced fit model.

Ans:

Lock and Key Model	Induced Fit Model
1. Active site is a rigid structure.	Active site is flexible structure.
2. Active site of enzyme cannot modifies.	Active site of enzyme modifies with substrate.
3. Enzyme and substrate work like a lock and key.	Enzyme and substrate work like hand and glove.

Q2: In what way does an enzyme affect the chemical reaction it catalyses?

Ans: Enzyme catalyzes a chemical reaction by the following ways:

- 1. It lowers the activation energy.
 - 2. By squeezing and stretching the bond of substrate.
 - 3. By changing the shape of substrate.
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Q3: What will be the effect on digestion if we take some digestive enzymes from outside?

Ans. Outside digestive enzyme will not work properly in our body due to the following reasons:

1. They are not work properly in our internal body temperature.
2. It is not directly used in a chemical reaction.
3. It cannot modify itself according to substrate in the body.

Q4: What is meant by denaturation of enzyme?

Ans. Enzyme denaturation means changes in the structure of enzyme. As we know that enzymes are made of proteins. Due to high temperature the bond present (peptide bond) in enzyme will breaks and their shape damages. Then it will not function further.

Q5: How are enzymes specific for the substrate?

Ans. Enzyme contains a special site for attachment of substrate called active site. The active site of each enzyme is design such that it can only bind to specific substrate.

Q6: What are the terms used to describe the temperature and the pH at which an enzyme can work most effectively in a reaction?

Ans. The term "optimum" is used to describe the temperature and pH of which an enzyme works e.g.

1. Optimum temperature for enzymes in human body is 37°C. Temperature above or below from optimum (37°C) can affect the rate of

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enzyme action.

2. Every enzyme has its own optimum pH on which it works best.

Optimum pH	Enzymes
2	Pepsin
7-8	Trypsin
4-5	Amylase

Long Questions

C. Write detailed answers for the following questions:

Q1: Describe the factors which affect enzymes activities.

Ans: Please see Question number...

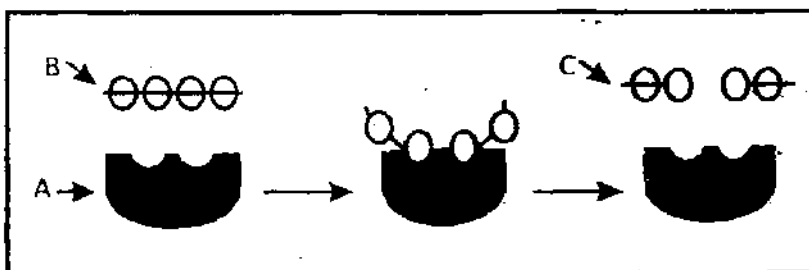
Q2: Explain mode of action of an enzyme in a reaction.

Ans: Please see Question number...

Q3: Write the various properties of enzymes.

Ans: Please see Question number...

Q4: The diagram below shows the relationship between an enzyme, a substrate and the products of an enzyme catalyzed reaction.



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a. What is represented by the parts labeled A, B and C in the diagram?

Ans. A = it shows substrate

B = it shows enzyme

C = it shows product

b. Name two properties of enzymes that are represented in this diagram. What will happen to the chemical reaction if the enzyme is removed?

Ans. Two properties of enzyme that are shown in this diagram are:

1. Substrate is attached to active site.

2. Enzyme remains unchanged after the completion of reaction.

If an enzyme is removed from chemical reaction it will slow down.

c. What will happen to the rate of reaction if the reaction temperature is raised steadily: (i) from 25°C to 35°C, and (ii) from 40°C to 60°C?

Ans. If the temperature is raised from 35°C to 40°C it will accelerate the rate of reaction.

If the temperature is raised from 40°C to 60°C it will denature the shape of an enzyme and hence the reaction will stop.

d. What term is used to describe the condition of the enzyme when it is heated to a temperature of 60°C and above?

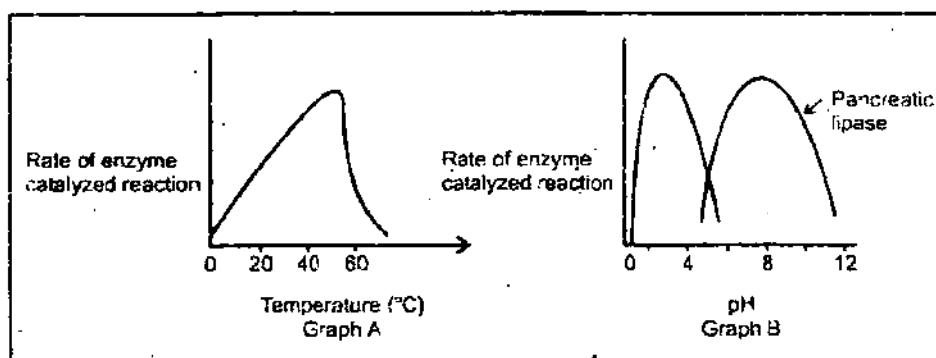
Ans. The term denaturation is used to the condi-

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tion of enzyme when its temperature raised to 60°C or above.

Q5: The graph below shows the rate of enzymatic reaction.



a. According to graph A, at which temperature the enzyme activity is highest. When temperature increases above this point, what will happen to the enzyme?

Ans. According to graph A, the enzyme activity is maximum at 40°C . Temperature above this point which denatures the enzyme.

b. According to graph B, what is the optimum pH for (i) pepsin, and (ii) lipase? As pH moves away from the optimum value, what will happen to the enzyme activity?

Ans. According to graph B:

Optimum pH for pepsin = 2

Optimum pH for lipase = 8

As pH moves away from optimum will decrease and the rate of reaction will be slow down.



BIOENERGETICS

Q1: What is bioenergetics?

Ans. Bioenergetics: (Bio-life, energy, energy, its-transformation)

"The study of transformation of energy in a living system is called bioenergetics."

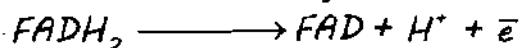
Explanation:

All living cells are able to transform energy i.e. green plants capture energy from sunlight by the process of photosynthesis, they convert this energy into chemical energy of food. This energy is then transfer to animals for the use of various activities.

Q2: Discuss the importance of oxidation and reduction reaction.

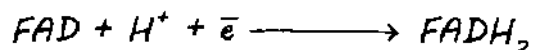
Ans. 1) Oxidation:

"The loss of electrons or hydrogen from a molecule is called oxidation." e.g.



2) Reduction:

"The gain of hydrogen or electron is called reduction."



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Importance of Oxidation-Reduction:

1. Due to oxidation-reduction CO_2 and H_2O combines to make food during photosynthesis.
2. Respiration is also oxidation-reduction process in which food molecules are broken down to release energy.
3. Due to oxidation-reduction reaction various energy molecules are transfer from cell to cell in a living body.

Q3: Explain that ATP is the energy currency of living cell.

Ans: ATP (Adenosin Tri Phosphate):

"It is an energy rich molecule and is called the energy currency of living cell." For storage of energy cell makes ATP. If a cell gets energy they break ATP.

Structure of ATP:

ATP molecule is made of three components:

1. Adenine (a nitrogenous base)
2. Ribose sugar (5-carbon sugar)
3. Three phosphates

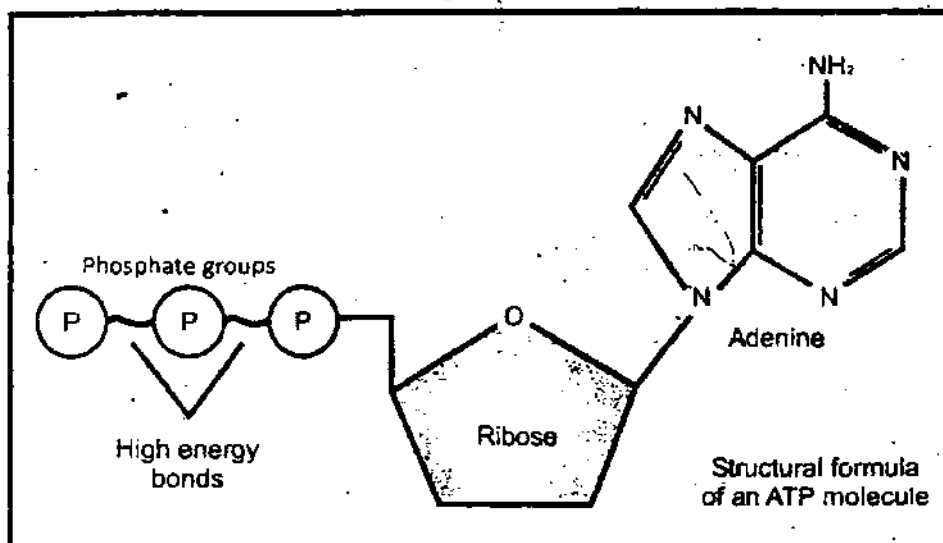
Adenine + ribose \Rightarrow adenosine

Adenosin + P \Rightarrow AMP

AMP + P \Rightarrow ADP

ADP + P \Rightarrow ATP

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When a cell needs energy, one bond between phosphate group is broken it release 7.3Kcal energy. If one phosphate is removed the ATP are converted into ADP. If the cell has energy it combines phosphate with ADP and form ATP again.

Q4: What is photosynthesis. (نیائی تالیف کیا ہے؟)
(BISE Kohat, Mardan 2015)

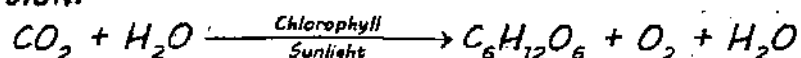
Ans: Photosynthesis (نیائی تالیف): (Photo-light, synthesis-to manufacture)

"The process by which green plant prepares food from CO₂ and H₂O in the presence of sun light is called photosynthesis."

Explanation:

Photosynthesis is energy capturing and storing process.

Reaction:



Photosynthesis is a Life Sustaining Process:

Due to photosynthesis--green plants prepare its

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food. This food is not only used by plants but is serves a food for the entire life. All living organisms depend directly or indirectly on plants. There would be no life without plants.

Q5: Explain role of chlorophyll in photosynthesis. (BISE Abbottabad 2016)

Ans: Chlorophyll (سبز):

1. It is a green colour pigment in plants.
2. It absorbs sun light (blue and red light) and convert into chemical energy.
3. Chlorophyll appears green because it reflects the green colour of sun light.
4. When chlorophyll absorbs sun light it becomes excited and released electron. The energy of this excited electron is used in making ATP.

Types of Chlorophyll:

1. Chlorophyll a found in all plants.
2. Chlorophyll b found in some green plants and in algae.

Carotenoids: (Accessory pigment)

1. It is a pigment that absorbs light in visible spectrum ranging between 430-470nm.
2. Carotenoids include xanthophylls and carotene.
3. It absorbs light and transfer energy to chlorophyll "a".

Photo system:

"When photosynthetic pigments form a clustered, it is called photo system." There are two types of photosynthesis:

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1. Photo system-I (PSI)
2. Photo system-II (PSII)

**Q6: What is the role of light in photosynthesis?
(BISE Malakand 2018)**

Ans. Role of light in photosynthesis:

Light is a kind of energy that travels in the form of electromagnetic waves.

1. Sun is the main source of energy for all living organisms.
2. The visible spectrum of light are absorbed by photosynthetic pigment i.e. (390-760nm).
3. Without sun light photosynthesis does not take place.

Q7: How plants take CO₂ and water?

Ans. Intake of CO₂ by Plants:

1. CO₂ is a gas which is present in air (0.01-0.03%).
2. It is one of the raw materials for photosynthesis.
3. CO₂ is taken by plants through stomata.
4. From outside (environment) CO₂ is diffused to intracellular space of leaf through stomata.
5. Stomata are small opening present in lower epidermis of leaf.
6. Each stomata contains two guard cells.
7. Opening and closing of stomata regulates the diffusion of CO₂.
8. After diffusing to intracellular space CO₂ is attached to the wet surface of mesophyll cells.
9. From here it moves to stroma of chloroplast.
10. During dark reaction CO₂ is helping to make glucose.

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Intake of Water:

1. Plants take water from soil through roots.
2. Then through xylem vessels it moves upward to other parts of plant body.
3. In leaves water is used in photosynthesis.
4. The extra water is transpired from leaves through stomata.

Q8: Explain the mechanism of photosynthesis.

Ans. The process of photosynthesis completes in two steps:

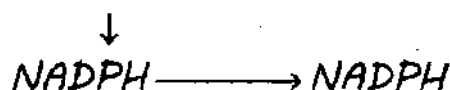
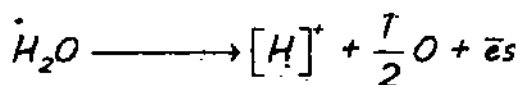
1. Light reaction
2. Dark reaction

1) Light Reaction: (Photochemical reaction)

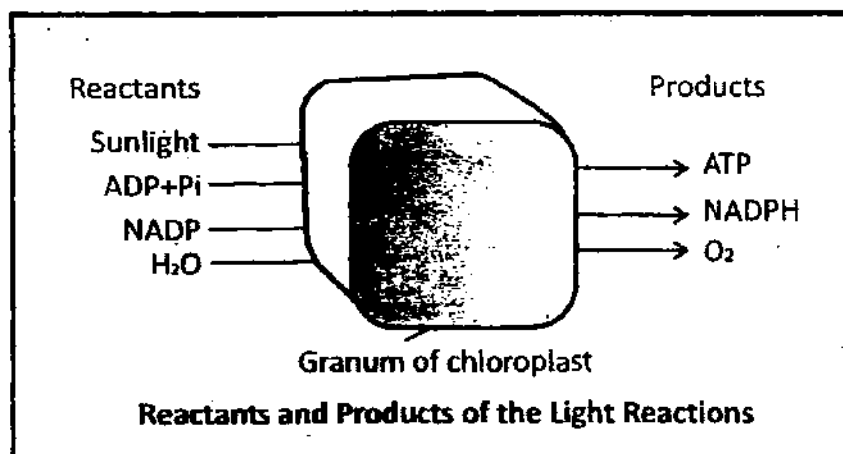
1. It is light dependent reaction means that it occurs in the presence of sun light.
2. It takes place in the granum of chloroplast.

Mechanism of Light Reaction:

1. When light energy is fall on chlorophyll it excited the electrons of chlorophyll.
2. These high energy electrons are passes through a chain of electron carrier during which it releases energy that forms ATP.
3. Light energy also breaks the H_2O molecule (photolysis of water).
4. H_2O is splits into oxygen and hydrogen.
5. Oxygen is released to outside while H-atom is used to reduce NADP to NADPH.



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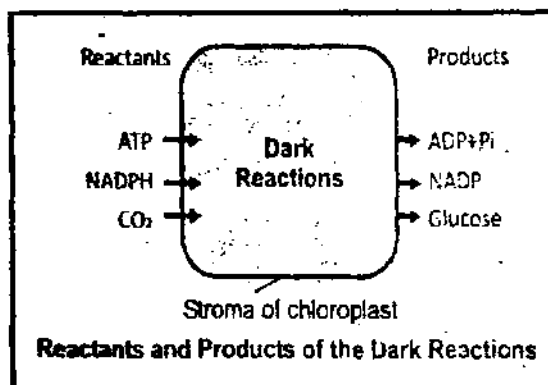


2) Dark Reaction: (Calvin cycle)

1. It was discovered by Malvin Calvin so called Calvin cycle.
2. It is also called biosynthesis pathway.
3. This reaction occurs in the granum of chloroplast.
4. It is light independent reaction i.e. it does not require sun light.

Mechanism:

1. CO_2 from air enters into stroma and combines with Ribolose biphosphate (Rulp) which is a 5 carbon sugar.
2. Then it forms 3-carbon molecule called phosphoglyceral dehyde (PGA).
3. This phosphoglyceral dehyde (PGA) form glucose molecule.



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Q9: Explain limiting factors for photosynthesis.

Ans. Limiting Factors:

1. Those factors which finishes first in a chemical reaction.
2. Any environmental factor which is finished in a reaction and due to which a chemical reaction is stopped or its rate decreases.

Limiting Properties:

For photosynthesis many factors are act as a limiting factor e.g. temperature, CO_2 , H_2O and light intensity.

Q10: Discuss factors that affect the rate of photosynthesis. (BISE Abbottabad 2015)

Ans. Factors affecting rate of photosynthesis are given below:

1) Effect of Light:

1. Light is a form of energy which is trapped by chlorophyll.
 2. Chlorophyll converts this light energy into chemical energy.
 3. The quality and intensity (شدت) of light affects the process of photosynthesis.
 4. Very intense light damages chlorophyll and indirectly affect photosynthesis.
 5. Very weak light has low energy and it lowers the rate of photosynthesis.
 6. So, light intensity is directly proportional to photosynthesis.
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2) Effect of CO₂ Concentration:

1. Concentration of CO₂ is directly proportional to photosynthesis. When CO₂ concentration is high it will increase the rate of photosynthesis.
2. When stomata is closed the concentration of CO₂ falls down in mesophyll tissues so it lowers the rate of photosynthesis.

3) Effect of Temperature:

1. An optimum temperature is required for photosynthesis.
2. Optimum temperature for photosynthesis is ranging between 20°C - 30°C.
3. Temperature above or below from optimum temperature affects the rate of photosynthesis.
4. However some plants growing in dry and hot areas and in cold regions have developed adaptation for high and low temperature.

Q11: Explain respiration and its types.

Ans. Respiration:

(BISE Peshawar 2016, Swat 2017)

It is an oxidation-reduction process in which energy is released from food in the form of ATP.

Explanation:

1. During respiration the organic food molecule (glucose) is broken down into CO₂ and H₂O.
 2. It is a catabolic process in which energy is released from food.
 3. Respiration is common in all living organisms.
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Types of Respiration:

There are two types of respiration:

1. Anaerobic respiration
2. Aerobic respiration

**Q12: Explain anaerobic respiration.
(BISE Peshawar 2016)**

Ans. Anaerobic Respiration:

"The respiration that occurs in the absence of oxygen is called anaerobic respiration."

1. In this type of respiration the food is not completely broken down.
2. It produces less energy.
3. It occurs in the cytoplasm of a cell.

Types of Anaerobic Respiration:

There are two types of anaerobic respiration:

1. Lactic acid fermentation
2. Alcoholic fermentation

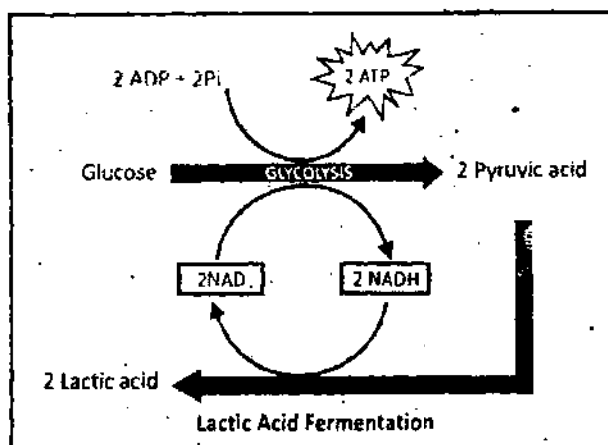
1) Lactic Acid Fermentation:

1. The process in which glucose are converted in lactic acid.
2. It occurs in RBC and muscle cells of human body.

Mechanism:

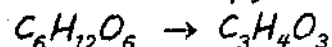
It completes in two steps:

1. In first gly-

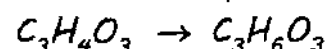


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colysis occurs in which the glucose are converted into pyruvic acid.



2. In the next step pyruvic acid is converted into lactic acid.

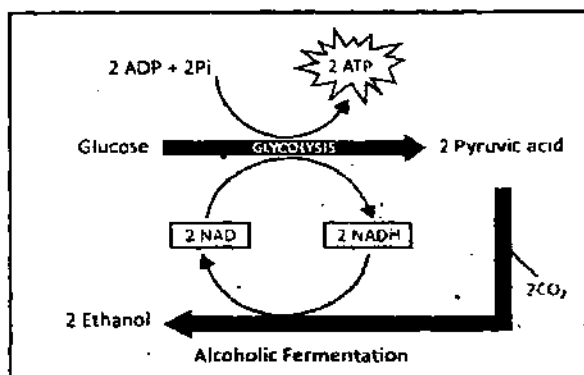


2) Alcoholic Fermentation:

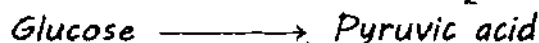
"The conversion of glucose into alcohol is called alcoholic fermentation."

1. It usually occurs in yeast.
2. It completes in two steps:

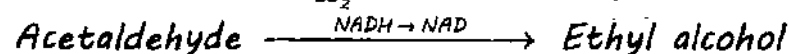
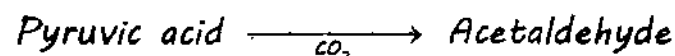
- The first step is glycolysis in which glucose is broken down to pyruvic acid and



NAD is reduced to $NADH_2$.



- In the next step the pyruvic acids are converted into acetaldehyde and CO_2 molecules are released.
3. Then acetaldehydes are converted into ethyl alcohol.



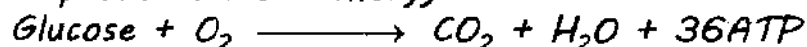
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Q13: Explain aerobic respiration and its steps.

Ans. Aerobic Respiration:

"The respiration that takes place in the presence of oxygen is called aerobic respiration."

1. In this the food molecule is completely broken down.
2. It produces more energy.



Mechanism:

Aerobic respiration completes in 3 steps:

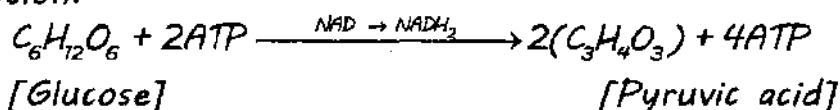
1. Glycolysis
2. Krebs cycle
3. Electron transport chain

1) Glycolysis: (Glyco-glucose, lysis-splitting)

"The process in which one glucose molecule is broken down into two molecules of pyruvic acid is called glycolysis."

It occurs in the cytoplasm of a cell. Here net gain of two ATP occurs.

Reaction:



In glycolysis two ATP molecules is used but it gives us four ATP in last. So net gain of 2 ATP occurs.

2) Krebs Cycle: (Citric acid cycle)

1. It was discovered by Hans Krebs so called Krebs cycle.
2. It occurs in the mitochondria of a cell.

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Mechanism:

1. The pyruvic acid is converted into acetyl CoA (2-carbon molecules).
2. Acetyl CoA enters into mitochondria where it performs a series of reaction in which it is oxidized.
3. These reactions produce ATP, NADH_2 and FADH_2 .

Total energy gain

ATP = 2

$\text{NADH}_2 = 6$

$\text{FADH}_2 = 2$

3) Electron Transport Chain:

1. It is the last step of aerobic respiration.
2. In this the electron which is produced by oxidation of NADH_2 and FADH_2 are passed through a series of electron carrier (cytochrome).
3. It occurs in the cristae of mitochondria.

Mechanism:

1. Here oxidation of reduced co-enzyme occurs ($\text{NADH}_2 + \text{FADH}_2$).
 2. Oxidation of $\text{NADH}_2 + \text{FADH}_2$ release electrons and hydrogen ion.
 3. These electrons are moves through a series of electron carriers (cytochroma).
 4. When a pair of electrons move from cytochrome to cytochroma it losses energy which are used to synthesize ATP from ADP and ip.
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5. At the end the oxygen molecule accept electrons to form water.

Q14: How much energy is produced during respiration?

Ans. When one glucose molecule is completely broken down, it releases 38 ATPs. But during glycolysis 2 ATP is used so net gain of total ATP is 36 from one glucose. Some energy is produced in glycolysis, some energy is produced in Krebs cycle and electron transport chain.

Q15: Compare aerobic and anaerobic respiration. (BISE Abbottabad 2015m, Malakand 2018)

Ans.

Aerobic	Anaerobic
1. It occurs in the presence of oxygen.	It occurs in the absence of oxygen.
2. In this food is completely broken down.	Food is incompletely broken down.
3. Produces more energy.	Produces less energy.
4. Net gain = 36 ATP	Net gain = 2 ATP
5. It occurs in cytoplasm and mitochondria.	It occurs only in cytoplasm.
6. Products $\rightarrow \text{CO}_2 + \text{H}_2\text{O}$	Products: Lactic acid and alcohol

BIOLOGY NOTES FOR 9TH CLASS (FOR KHYBER PAKHTUNKHWA)

7. It is major type of respiration.	It is minor type of respiration.
8. It is more efficient.	It is less efficient.

**Q16: Compare photosynthesis with respiration.
 (BISE Swat 2017)**

Ans.

Photosynthesis	Respiration
1. Energy storing process.	Energy releasing process.
2. It is anabolic process.	It is catabolic process.
3. Occurs only in green plants.	Occurs in all living organisms.
4. It occurs at day time.	Occurs at day and night.
5. Reactants $\rightarrow \text{CO}_2 + \text{H}_2\text{O}$	Reactant - Glucose + O_2
6. Products $\rightarrow \text{Glucose} + \text{O}_2$	Products: $\text{H}_2\text{O} + \text{CO}_2$
7. Weight gaining process	Weight losing process

EXERCISE

A. Encircle the best suitable answers.

1. The site of the cells for the dark reaction is:
(a) Mitochondria
(b) Ribosome
(c) Granum of chloroplast
✓ (d) Stroma of chloroplast
 2. The organisms responsible for trapping light energy are:
(a) Plants
(b) Algae
✓ (c) Photosynthetic organisms
(d) Fungi
 3. Photosynthesis takes place in:
✓ (a) Mesophyll cells
(b) Guard cells
(c) Phloem cells
(d) All of the above
 4. One of the following is not a limiting factor for enzymes in photosynthesis:
(a) CO₂ concentration
(b) Temperature
(c) Light intensity
✓ (d) Pigments
 5. One of the following pair of light colours is important for photosynthesis:
(a) Green and yellow
(b) Yellow and orange
-

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- (c) Green and orange
✓ (d) Red and blue
6. One of the following may not be required for respiration:
- (a) Oxygen (b) Food molecule
(c) Enzymes ✓ (d) CO₂
7. In the structure of ATP, the three phosphate groups are linked to:
- ✓ (a) Ribose (b) Glucose
(c) Adenine (d) H₂O
8. A car engine uses fuel for work to do. The carry out functions, a living cell uses:
- (a) Electric power
(b) Generator
✓ (c) ATP
(d) Heat energy
9. Inside a bacterial cell, glycolysis occurs in:
- (a) Mesosome
✓ (b) Cytoplasm
(c) Mitochondria
(d) Nucleoid
10. The consumption during the conversion of pyruvic acid into ethanol during anaerobic respiration is / are:
- (a) One NADH₂ (b) One NADH₂ & CO₂
✓ (c) Two NADH₂ (d) Only CO₂

Short Questions

B. Write short answers for the following questions:

Q1: Why ATP regarded as the currency of the living cell? (BISE Swat 2017)

Ans: ATP is regarded as the currency of living cell because ATP is required for function of a cell. Without ATP cell does not perform its function. When a cell requires energy for work it utilizes ATP. The bonds of ATP break that provide energy to cell for its work. In the absence of ATP a cell will not be able to perform work.

Q2: What is the role of pigment during photosynthesis?

Ans: Pigment is any substance that absorbs sunlight.

1. Photosynthesis pigment absorbs light energy.
2. This energy is used in light reaction of photosynthesis to make ATP.
3. There are two types of photosynthesis pigments.
 - a. Chlorophyll
 - b. Carotenoids
4. These two pigments absorb light of various wavelengths.

Q3: Draw the structure of ATP molecule.

Ans: ATP molecule is composed of three components.

1. Ribose sugar (5-carbon sugar)

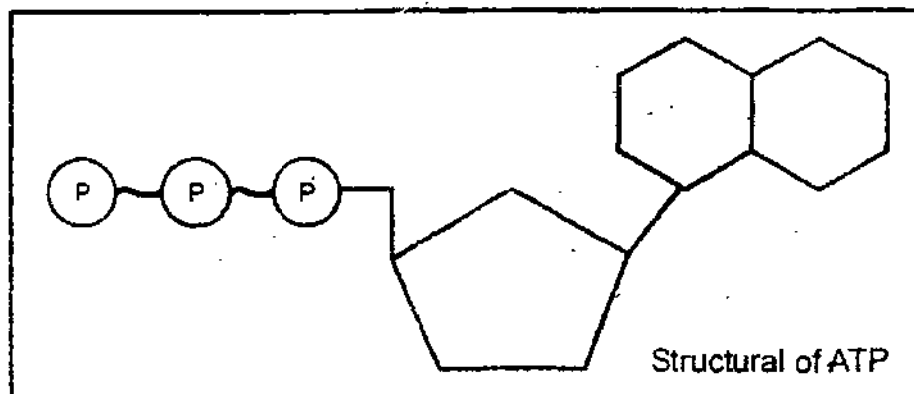
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2. Adenine

3. Phosphate

Adenine + ribose \Rightarrow Adenosin

Adenosin + 3 phosphate = ATP



Q4: Compare lactic acid fermentation with alcoholic fermentation.

Ans

Lactic Acid Fermentation	Alcoholic Fermentation
1. Conversion of glucose into lactic acid.	Conversion of glucose into alcohol.
2. It occurs in bacteria, RBC and skeletal muscles.	It is mostly occurs in yeast.
3. No release of CO_2 occurs.	CO_2 molecule is released.
4. Glucose \rightarrow Lactic acid	Glucose \rightarrow Acetaldehyde \rightarrow Ethyl alcohol

Q5: Why are oxidation and reduction important for plants?

Ans. Oxidation and reduction are important for

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plant because:

1. Due to oxidation and reduction CO_2 and H_2O combine to make food during photosynthesis.
2. Respiration is also oxidation and reduction process in which food molecule is broken down.
3. Due to oxidation and reduction reaction energy is produced in living cells.

Long Questions

C. Write detailed answers for the following questions:

Q1: Explain the mechanism of photosynthesis.

Ans. Please see Question number...

Q2: What is the concept of limiting factor? What are the different limiting factors for photosynthesis?

Ans. Please see Question number...

Q3: Why is aerobic respiration considered to be more efficient than anaerobic respiration?

Ans. Aerobic respiration is more efficient than anaerobic due to the following reasons:

1. In this food molecules are broken down completely.
2. It produces more energy.
3. Net gain of 36 ATP occurs in aerobic while in anaerobic only 2 ATP molecules are gained.

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4. If more ATP molecules are produced it will give more energy to a cell for working.

Hence aerobic respiration is much efficient than anaerobic.

Q4: Aerobic respiration generates more ATP molecules than anaerobic respiration. Which processes of aerobic respiration are responsible for this higher energy generation of ATP and how?

Ans: Aerobic respiration generates more ATP i.e. 36 ATP.

1. During aerobic respiration the food is broken down completely.
2. In this type the products of glucose moved to mitochondria where it produces more ATP.

Total ATP of aerobic respiration

Glycolysis = 2 ATP

= 2 NADH_2 = 4 ATP

Link reaction = 2 NADH = 6 ATP

= 6 NADH_2 = 18 ATP

= 2 FAD = 4 ATP



- وقت سے پہلے اور قسمت سے زیادہ کبھی نہیں ملے۔
- چھوٹے ذہنوں میں ہمیشہ خواہشیں اور بڑے ذہنوں میں ہمیشہ معاصد ہوا کرتے ہیں۔

NUTRITION

Q1: Define nutrition.

غذائیت کیا ہے؟

Ans: Nutrition:

"The process of intake of food and utilize their energy is called nutrition."

Explanation:

All living organisms need nutrients for growth, repair and maintenance of different activities. The nutrients are obtain from plants and soil.

Q2: Discuss mineral nutrition in plants.

Ans: Minerals (معدنات):

These are substances which obtain from soil. They include salts that contain Ca, Mg, K, Na etc.

Mineral Nutrition:

"The process which deals how plants get minerals and where they use them is called mineral nutrition in plants."

Types of Nutrients:

There are two types of nutrients:

1. Macronutrients
2. Micronutrients

1) Macronutrients:

"Those nutrients which are requires in greater

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amount are called macronutrients."

They are required 100mg per day. There are nine macronutrients i.e. C, H, O, N, K⁺, P, S, Ca²⁺ and Mg²⁺.

2) Macronutrients:

"Those nutrients which are requires in small amount are called micronutrients."

They are requires 20mg per day. They include boron, copper, iron and Na etc.

Role of Mineral Element in Plants:

Iron	Necessary for photosynthesis, activates many enzymes.
Molybdenum	Part of the enzyme that reduces nitrates to ammonia, important in making amino acids.
Boron	Important for sugar transport, cell division and certain enzymes.
Copper	Required for functioning of several enzymes.
Manganese	Involved in enzyme activity for photosynthesis, respiration and nitrogen metabolism.
Zinc	Required for the functioning of many enzymes.
Chlorine	Involved in osmosis of water.
Nickel	Required in nitrogen metabolism.

Q3: What is the role of nitrogen in plants?

(BISE Mardan, Malakand 2014, Bannu 2014, Ab-

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bottabad 2016)

Ans. Role of Nitrogen in Plants:

Nitrogen is a gas which is present in atmosphere (78%). Nitrogen is the major component of some molecules which are given below:

1) Proteins:

Protein is made of amino acid and amino acid contains nitrogen.

2) Vitamins:

Nitrogen helps in the synthesis of vitamins.

3) Nucleic Acid:

DNA and RNA contains nitrogenous base which contain nitrogen.

4) Hormones:

The structure of hormone also contains nitrogen.

5) Pigments:

Plants pigment such as chlorophyll contains nitrogen which play role in photosynthesis.

- Deficiency of nitrogen
- Reduce yield
- Yellowing of leaves
- Stunt growth

Q4: What is the role of magnesium in plants?

Ans. Role of Magnesium:

1. Magnesium is a central part of chlorophyll so for the synthesis of chlorophyll plants need magnesium.
2. Magnesium is also required for the activation of many enzymes.

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3. It helps in photosynthesis.

Deficiency of Magnesium:

1. Yellowing of leaves (chlorosis)
2. Low level of magnesium effect metabolism.
3. It leads to necrosis (cell death).

Q5: What are fertilizers? Write its importance.

Ans. Fertilizers:

"The substances which increase the fertility of soil are called fertilizers."

Explanation:

1. Plants need nutrients for growth and development.
2. They obtain these nutrients from soil as a result the soil become deficient of nutrients.
3. In nutrient deficient soil plants do not grow properly.
4. For proper growth and development of plant fertilizers are added to soil.

Types of Fertilizers:

There are two types of fertilizers:

1. Organic fertilizers
2. Inorganic fertilizers

1) Organic Fertilizers:

1. These fertilizers are obtained from animals and plant materials.
2. These fertilizers are obtained from manure, seaweed, hay, leaves, wood chips and seed hulls etc.

Advantages of Organic Fertilizers:

1. It improves the structure of soil.
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2. It retains soil moisture.
3. It increases aeration.
4. It increases the fertility of soil.
5. It improves the quality of soil.
6. Less risk of leaching.
7. They are cheap.
8. It does not cause any pollution.

2) Inorganic Fertilizers:

These fertilizers are derived from chemical compounds such as ammonium nitrate, ammonium phosphate and potassium chloride.

Examples:

Sodium nitrate, mined rock, phosphate and lime stone.

Advantages of Inorganic Fertilizers:

1. It contains accurate amount of nitrogen that promotes protein and chlorophyll synthesis.
2. It encourages the growth of stem and leaves.
3. It results in more flowering due to phosphate.
4. It also results higher fruits and healthier roots.

Q6: Explain environmental hazards related to use of chemical fertilizers.

Ans: Environmental Hazards related to the use of Chemical Fertilizers:

1. It increases salinity of soil which leads to improper growth of plants.
 2. It also increases the acidity of soil.
 3. It causes the pollution of underground water.
 4. Bad smell from these fertilizers pollutes the air.
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5. Some nitrogen fertilizer causes emission of green house gases.
6. It causes eutrophication.

Eutrophication: It is a condition in which the algae cover the upper surface of water.

Q7: What are carbohydrates?

Ans. Carbohydrates:

These are organic compounds composed of carbon, hydrogen and oxygen. In carbohydrates the ratio of hydrogen and oxygen is same as in water (2:1). We obtain most carbohydrates in the form of starch. Our digestive system converts this starch to glucose.

Sources of Carbohydrates:

Wheat, cereals, potato, bread and rice etc.

Functions of Carbohydrates:

1. It is the rich source of energy. If one gram of carbohydrates are fully oxidized it produces about 4 kilocalorie energy.
2. Carbohydrates are reserve food material in animals and plants. In animals the extra glucose is converted in glycogen and store in muscle and liver.
3. Carbohydrate makes the structure of living organisms.
4. It also helps in the formation of cell membranes.

Q8: What are proteins? (BISE Swat 2017)

لمیات کیا ہے؟

Ans. Proteins:

The word "protein" is derived from proteios which

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means supreme or first importance.

1. *Proteins are organic compounds composed of C, H, O, N and some time sulphur.*
2. *Proteins are macromolecules which are formed of small units called amino acids.*
3. *There are 20 different types of amino acids that form different proteins.*

Sources of Protein:

Meat, fish, egg, liver, bean, poultry and dry fruits.

Digestion of Proteins:

1. *Proteins are large molecules so they cannot get directly into our blood.*
2. *Our digestive system breaks proteins into amino acids by enzymes.*

Functions of Proteins:

1. *Proteins are rich source of energy.*
2. *These are structural and building materials of bio-membranes.*
3. *All enzymes are proteins.*
4. *Some hormones are proteins.*
5. *Our body muscle is made of proteins.*
6. *Hemoglobin is a protein that transports gases in our blood. One gram of protein contains four kilocalories of energy.*

Q9: What are fats?

کیا کیا ہے؟

Ans: Fats (Lipids):

Fats are organic compounds composed of C, H and oxygen. They are mostly made of fatty acids and glycerol.

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Properties:

1. They are non-polar.
2. They are insoluble in water.
3. They contain more C-H than OH.

Functions:

1. It is rich source of energy.
2. It stores greater energy than carbohydrates.
3. Fats are stored in adipose tissues.
4. They act as a building material for all bio-membranes.
5. It provides isolation to various organs of the body.
6. It maintains healthy skin and hairs.
7. Fats also store fats soluble vitamins.

Sources of Fats:

Butter, ghee, cheese, meat, milk and nuts.

Q10: What are vitamins? (BISE Swat 2017)

جائین کیا ہے؟

Ans: Vitamins:

These are organic substances found only inside the body of living organisms. Our body cannot manufacture vitamins. It must be supplied to the body in food. Vitamins are necessary to the normal functioning of our body.

Types of Vitamins:

There are two types of vitamins:

1. Fat soluble vitamins
2. Water soluble vitamins

1) Fat Soluble Vitamins:

These vitamins are dissolved in our body fats. The

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deficiency of this vitamin is rare.

Examples: A, D, E and K (ADEK).

2) Water Soluble Vitamins:

These vitamins are dissolved in water. The deficiency of this type of vitamins occurs mostly because they expelled through urine and sweat.

Examples: Vitamin-C and Vitamin-B complex.

Q11: Explain vitamin A.

Ans. Vitamin-A:

It is also called retinol. It is fat soluble vitamin. It function more in retina of the eye so called retinol.

Sources:

Eggs, milk, butter, cod liver oil, sweet potato, carrot, spinach, oranges and mangoes.

Functions:

1. It helps in growth.
2. It promotes immune system.
3. It helps in reproduction.
4. It increases vision.
5. It maintains healthy skin.

Deficiency of Vitamin-A:

1. Night blindness
2. Xerophthalmic (dryness of eye)
3. Xerosis (dryness of eye)
4. Infertility
5. Delay function of immune system.

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Q12: What is vitamin-C?

Ans. Vitamin-C: (Ascorbic acid)

It is a water soluble vitamin.

Sources:

Citrus fruit i.e. lemon, orange, grapes, strawberries, broccoli and cabbage etc.

Functions:

1. *It is needed for growth and repair.*
2. *It helps the body to make collagen.*
3. *It maintains healthy bones and teeth.*
4. *It is required for healing of wounds.*
5. *Vitamin-C along with vitamin-E is an antioxidant.*

Deficiencies:

1. *Dry hairs*
2. *Rough skin*
3. *Decrease wound healing*
4. *Inflammation of bleeding and gums*
5. *Weaken immune system*
6. *Scurvy (bloody and swell gums)*

Q13: What is vitamin-D?

Ans. Vitamin-D: (Calciferol)

It is fat soluble vitamin.

Sources:

1. *It is naturally present in few foods like egg yolk and cod liver oil etc.*
 2. *It is also produced under the skin when UV light falls on it.*
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Functions of Vitamin-D:

1. It maintains normal blood level of calcium and phosphorus.
2. It hardens the bone by the absorption of phosphorus and calcium.
3. It helps in maintaining normal teeth.

Deficiencies:

1. Brittle and soft bones.
2. Rickets: Vitamin-D deficiency in child causes rickets in which the bones of a child become weak and fragile.
3. Osteomalacia: It is a condition in which the bones of adults become weak and fragile.

Q14: What are minerals? Discuss its types.

Ans. Minerals (معدنات):

It is an inorganic substance that occurs naturally in the earth. Mineral cannot make by our body. It plays various roles in various functions of our body. We get minerals from plants, animals and water. Plants get minerals from soil.

Types of Minerals:

There are two types of minerals:

1. Major minerals
2. Trace minerals

1) Major Minerals:

These minerals are required in the amount of 100mg per day e.g. Na^+ , K^+ , Cl^- , Ca^{+2} , Mg^{+2} , P & S.

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2) Trace Minerals:

These minerals are required in amount less than 100mg per day e.g. F, Zn, Cu, Cr, Se and Mn etc.

Q15: Discuss the role of calcium and iron.

Ans. Role of Calcium:

It is the most important and abundant minerals in human body.

Sources:

Dairy products, eggs, green leafy vegetables, legumes, nuts, broccoli and whole grains.

Functions:

1. It plays role in the development of bones.
2. It plays role in blood clotting.
3. It helps in the transmission of nerve impulse.
4. It also helps in muscle contraction.
5. It plays role in metabolic activities.
6. It is need for the formation of teeth.

Deficiencies of Calcium:

1. Muscle cramps
2. Increase excitability of neuron.
3. Dry skin
4. Brittle nails

Role of Iron (Fe):

Iron is an important mineral which is found in hemoglobin. Hemoglobin is a respiratory pigment present in RBC for the transportation of oxygen.

Sources:

Red meat, fish bean, dried fruit, apple and green

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leafy vegetables.

Functions:

1. *It helps in the transportation of oxygen.*
2. *It helps to maintain immune system and nervous system.*

Deficiency:

1. *Anemia (low level of RBC)*
2. *Symptoms of anemia are fatigue, weakness, rapid heart rate etc.*

Q16: What are dietary fibers? Write its importance.

Ans. Dietary Fibers: (Roughage or Bulk)

The indigestible part of food is called dietary fibers. It moves unchanged through the digestive system. it is mainly composed of cellulose.

Sources:

It is found in vegetables, fruits and cereals.

Types of Dietary Fibers:

There are two types of dietary fibers:

1. *Insoluble dietary fibers*
2. *Soluble dietary fibers*

1) Insoluble Dietary Fibers:

1. *These fibers do not dissolve in water.*
 2. *It passes through small intestine very quickly.*
 3. *It is found in wheat bran, whole grain, breads, cereals, and the skin of many fruits and vegetables.*
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2) Soluble Dietary Fibers:

1. These fibers are soluble in water.
2. They break down as they pass from digestive tract.
3. It forms a gel that traps harmful substances.
4. It is found in oat, beans, barley and many fruits and vegetables.

Functions:

1. Dietary fiber prevents constipation.
2. It makes the stool soft.
3. It lowers the level of cholesterol in blood.
4. It controls weight by creating the feeling of fullness.

Q17: Write the importance of water in human body?

Ans. Water:

It is the most abundant substance in human body. Our body contains about 70% of water. The cytoplasm of our cell contains 90% water.

Importance of Water:

1. Water acts as solvent for reactions of metabolism.
2. It dissolves oxygen in blood, so oxygen is transported to every cell by blood.
3. It also dissolves CO_2 which is transported from tissue to lungs for removal.
4. Water stabilizes body temperature.
5. Water is the flushing medium for the removal of toxic material e.g. urea through kidney.
6. Almost every cell of the body is bath in it.

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terstitial cell which is almost water.

7. Saliva contains water in which food is dissolved and gives us taste.
8. Water acts as a lubricating medium. It is the major part of mucus.
9. Water acts as a reactant in many metabolic reactions e.g. hydrolysis.
10. The digested food is carried through blood which contains water.

Q18: What is balance diet?

متوازن غذا کیا ہے؟

(BISE Peshawar 2016, Kohat 2017)

Ans. Balance Diet:

"The diet which contains all the nutrients in proper amount is called balance diet."

A balance diet must contain carbohydrates, proteins, lipids, vitamins, minerals and water.

Importance of Balance Diet:

1. If there is not enough protein in our diet growth of our body will be affected.
2. Wound healing is due to balance diet.
3. Balance diet ensures proper health.
4. Balance diet contains proper amount of minerals and vitamins that are needed for proper health.
5. It contains proper amount of carbohydrates and fats that gives us energy for working.

Q19: Discuss energy requirements with age, gender and activity.

Ans. Relationship of Energy Requirement with Age:

1. During growth period, body needs food that

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contains more energy because at this stage new cells are formed.

2. Childs require more requirement of energy as compare to adult.
3. Childs also need more calcium and iron for the development of bone and blood cells.

Relationship of Energy with Gender:

Man has more metabolic rate than woman because man do hard work. So man needs more energy requirement than female.

Relationship of Energy Requirement with Activity:

Persons that are physically active require more energy than person that have sedentary habit.

Q20: What is malnutrition? Why it is considered to be a health hazard?

Ans. Malnutrition:

1. A condition that results from eating diet that contains too little nutrients or so many that causes health problems.
2. In malnutrition the required nutrients are not enough or over the required quantity.

Health Hazards of Malnutrition:

Severe malnutrition may results in heart diseases, constipation, obesity and death.

**Q21: Discuss major types of malnutrition.
(BISE Malakand 2018)**

Ans. Major types of malnutrition are:

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1. Protein energy malnutrition (PEM)
2. Mineral deficiency disease (MDD)
3. Over intake of nutrients (OIN)

1) Protein Energy Malnutrition (PEM):

1. It is a condition in which the body is not getting enough amount of proteins.
2. It may also occurs when the body cannot absorb such nutrients that contain carbohydrates, proteins and lipids due to a disease e.g. AIDS or cancer.

Disorder of PEM:

PEM results two disorders:

- a. Marasmus
- b. Kwashiorkor

a. Marasmus:

1. It is a disorder that is caused due to the deficiency of carbohydrates, proteins and fats.
2. It occurs more in childrens.

Symptoms:

1. Low body weight
2. Anemia
3. Stunt growth
4. Low muscle mass
5. Hypothermia (low body temperature)
6. Dry skin
7. Irritability

Treatment:

Balance diet

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b. Kwashiorkor:

1. It is a condition that results from the deficiency of proteins in diet.
2. It occurs in both children and adults.

Symptoms:

1. Thin body
2. Swollen stomach
3. Loss of teeth
4. Thin hairs
5. Its body cannot produce antibodies

Treatment:

Add proteins in diet.

2) Mineral Deficiency Disease (MDD):

It is a disorder that occurs due to low intake of minerals in diet.

Disorder of Mineral Deficiency Disease:

MDD can lead to the following diseases:

a. Anemia:

The low level of RBC or hemoglobin in the blood is called anemia.

Causes:

1. Low intake of iron
2. Poor absorption of iron

Symptoms:

1. Weakness
 2. Fatigue
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3. *Brittle hair*

4. *Hair loss*

5. *Brittle nails*

b. **Osteoporosis:**

1. *It is a condition in which the bone becomes porous and soft.*

2. *It is caused due to the deficiency of calcium in diet.*

c. **Goiter:**

The enlargement of thyroid gland is called goiter. Thyroid gland use iodine to make thyroxin and tri-iodothyronine.

Causes:

Deficiency of iodine.

Symptoms:

1. *Swollen neck*

2. *Difficulty in swallowing*

3. *Difficulty in breathing*

3) **Over Intake of Nutrients (OIN):**

Over intake of nutrition causes various disorders. It can lead to overweight and obesity.

a. **Obesity:**

Obese people suffer from hypertension, liver, renal and heart disorder.

b. *Excessive fats are deposited in the inner wall of blood vessels causes at arteriosclerosis.*

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- c. Excessive fats consumption also leads to heart defects and hypertension.
- d. Over intake of vitamin-D causes fatigue, vomiting and renal damage.
- e. Over intake of vitamin-A causes dry and itchy skin, painful swelling legs and spleen, enlargement of spleen etc.

Q22: Write some causes of malnutrition.

Ans. There are various causes of malnutrition. Some are given below:

- 1. Lack of knowledge of balance diet.
- 2. Poor absorption of nutrients.
- 3. Poverty
- 4. Do not taking diet regularly.
- 5. Famine (ب)
- 6. Drought

Q23: Define the following terms:

(i) Ingestion (ii) Digestion (iii) Absorption
(iv) Assimilation (v) Egestion

Ans. i) Ingestion:

"The intake of food is called ingestion."

ii) Digestion:

"The process in which the large food molecules are broken down into small food molecules is called digestion."

Types of Digestion:

There are two types of digestion:

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1. *Physical or mechanical digestion*

2. *Chemical digestion*

a. **Physical Digestion:**

In this the food is broken down by teeth and churning movement of stomach. It is done without chemicals (enzymes).

b. **Chemical Digestion:**

It is the chemical break down of food by various enzymes.

iii) **Absorption:**

"The process in which the digested food is uptake by blood from intestine is called absorption."

iv) **Assimilation (غذ):**

"The process in which the digested food become a part of a cell or makes new material for growth."

v) **Egestion:**

The process in which the undigested food is removed from the body.

Q24: Explain human digestive system in detail.

انسان کے نظام انہضام تفصیل سے بیان کریں۔

Ans. Digestive System (نظام انہضام):

It is an organ system which is responsible for the digestion of food. It is composed of alimentary canal and associated glands.

Alimentary Canal:

It is a muscular tube that starts from mouth and ends at rectum.

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Parts of Alimentary Canal:

It has the following canals:

1. Mouth (oral cavity)
2. Pharynx
3. Esophagus
4. Stomach
5. Small intestine
6. Large intestine

1) Mouth (Oral Cavity):

It is the first opening of alimentary canal. It receives food from outside. Its function is ingestion, taste and mastication of food.

Parts of Mouth:

- a. Teeth
- b. Tongue
- c. Salivary glands

a. Teeth:

It is collectively called dentition. Its function is the grinding, cutting and chewing of food. There are four types of teeth in human:

i) Incisor: They are chisel like cutting teeth used for biting of food.

ii) Canines: These are more pointed teeth used for tearing of food.

iii) Premolar and molar: These teeth have broad surface used for grinding of food.

2) Tongue:

1. It is a strong muscular organ.
2. Tongue contains

Do you Know?

A taste cell lives for 7-10 days.

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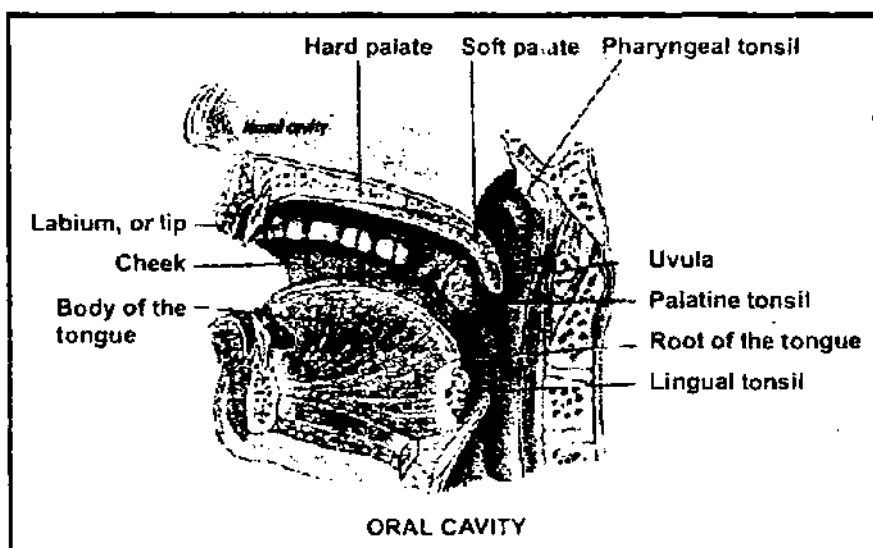
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taste buds that sense the taste of food.

3. *Tongue helps in rolling of food for chewing.*
4. *It also helps in swallowing.*

3) Salivary Glands:

1. *These glands produce saliva.*
2. *There are three pairs of glands in oral cavity.*



Saliva: *It is an alkaline watery fluid produced by salivary glands.*

Composition of Saliva:

1. **Mucus:** *It lubricates food.*
2. **Amylase:** *It digests carbohydrates.*
3. **Electrolytes:** *Na, K, Cl*
4. **Lysozyme:** *It kills microbes.*

Salivary Gland:

Oral cavity contains 3 pairs of salivary glands:

1. *Parotid gland*
2. *Sub-mandibular gland*

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3. Sub-lingual gland

4) Pharynx:

It is a muscular tube lies behind the nasal cavity.

Size: *It is about 4-5 inch long.*

Swallowing:

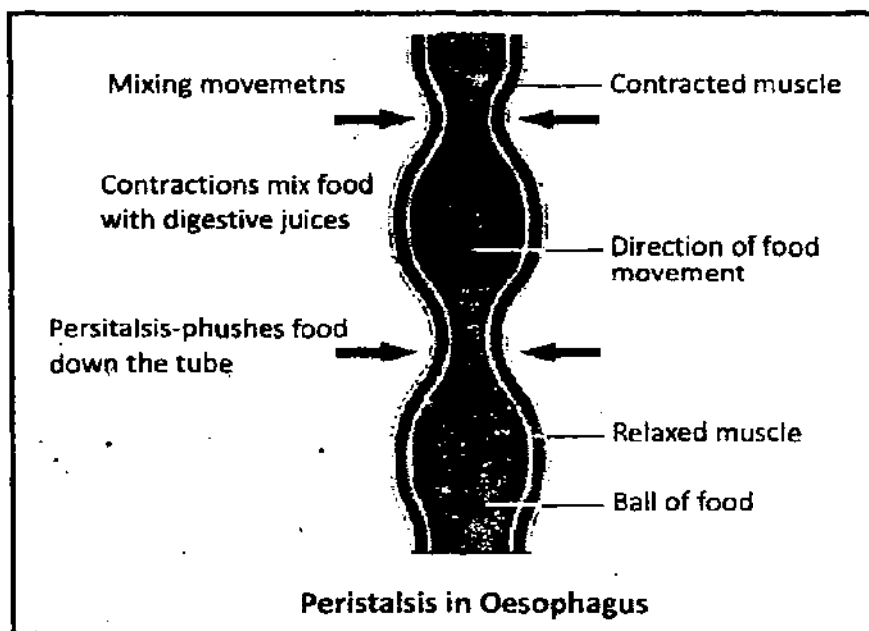
"The downward movement of food in food pipe of a food is called swallowing." During swallowing the food travels in food pipe by peristaltic movement.

4) Esophagus:

It is a muscular tube extended from pharynx to stomach.

Size: *It is about 10cm. long. Food is travel in esophagus by peristalsis.*

Peristalsis: *It is a wave like rhythmic contraction and relaxation in the walls of alimentary canal.*



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Anti-peristalsis: (Vomiting)

The reverse peristalsis of muscle of esophagus is called vomiting. It is due to irritation in the esophagus or stomach.

4) Stomach:

It is an elastic, muscular and thick walled sac. It is J-shaped. It is the dilated portion of alimentary canal.

Size: Its length is 25cm and width is 10cm. The capacity of stomach is one liter at the junction of esophagus and stomach cardiac sphincter is present. Cardiac sphincter prevents food from going back to esophagus.

Structure of Stomach:

It is composed of the following layers:

a. **Serosa:** It is the outer layer of stomach.

b. **Sub-mucosa:** It is the inner layer which contains gastric glands.

Gastric Gland: This gland secretes gastric juices. About 400-800 ml gastric juice is secreted at each meal.

Composition of Gastric Juices:

- i) HCl
- ii) Mucus
- iii) Pepsinogen

i) HCl (Hydrochloric Acid):

1. It converts pepsinogen into pepsin.

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2. It also kills microbes.

ii) Mucus:

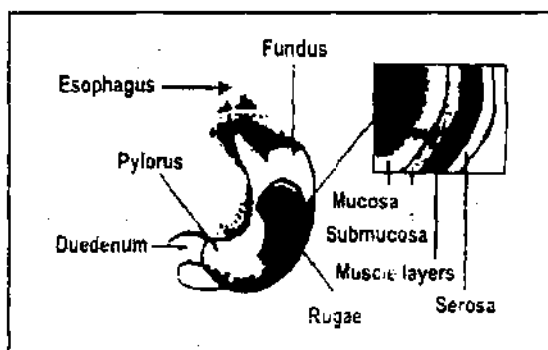
It coats the inner wall of stomach and prevents it from the action of HCl and pepsin.

iii) Pepsin:

It breaks large proteins into small chain of amino acids called peptides. At the lower end of stomach pyloric sphincter is present that controls the amount of food in stomach.

Functions of Stomach:

1. Formation of chyme from bolus
2. Storage of food
3. Digestion of proteins
4. It kills pathogen by HCl.
5. It helps in mechanical digestion.



5) Small Intestine:

1. It is coiled muscular tube which starts from stomach.
2. Its length is about 6 meter.
3. Its width is 2-4cm.
4. It is the longest part of digestive system.

Parts of Small Intestine:

It is composed of three parts:

- a. Duodenum
- b. Jejunum
- c. Illium

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a. Deudenum:

1. It is the first part of small intestine.
2. It is C-shape curved structure.
3. Its length is 12 inches.

Digestive Functions:

1. The chyme that comes from stomach are mixed here with biles and pancreatic juice.
2. Biles come from liver through bile duct.
3. The acidic chyme is neutralized by biles and pancreatic juice (alkaline).

Liver as a Digestive Gland:

Liver is the largest gland of a body.

Weight:

1. 1.4kg
2. It is reddish brown in colour and composed of two lobes.
3. Each lobe is further divided into small lobes.
4. Liver secretes biles.

Biles:

1. It is watery greenish liquid formed by liver cell.
2. It is stored in gall bladder.

Composition:

Water, electrolytes, cholesterol, sodium bicarbonate and phospholipids.

Functions:

1. It neutralizes the acidity of chyme.
 2. It kills microbes.
 3. It breaks down fats into small particles.
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4. It eliminates drug products and billurubin through digestive tract.

b. Pancreases as Digestive Gland:

It is the second largest gland of the body.

Weight: 60gm

1. It is pinkish in colour and leaf like in shape.

2. It secretes pancreatic juices.

Pancreatic Juices:

These are alkaline juice released from pancreases.

Composition:

Pancreatic juice is composed of digestive enzyme i.e. trypsin, amylase and lipase.

➤ **Trypsin:** It breaks proteins.

➤ **Amylase:** It breaks carbohydrates.

➤ **Lipase:** It breaks lipids.

Pancreatic juice is alkaline in nature, so it also neutralizes the acidity of chyme.

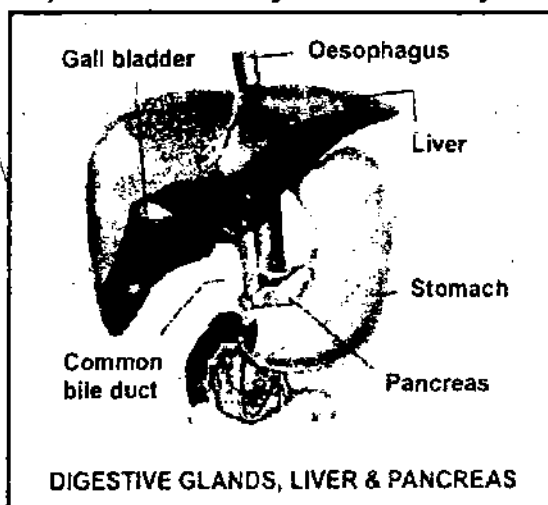
2) Jejunum:

It is the second part of small intestine. It is 4-7 feet long.

3) Ileum:

1. It is the last part of small intestine.

2. It is 5-7 feet long.



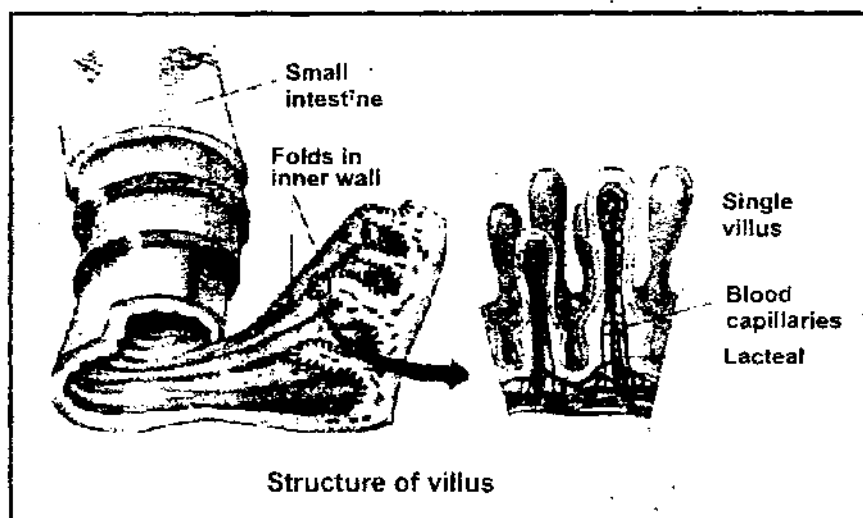
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3. It secretes intestinal enzyme that digested the remaining undigested food.
4. So the final digestion of food occurs here.

Absorption of Food in Small Intestine:

1. After complete digestion the food from small intestine is absorbed to blood.
2. The inner walls of small intestine have many folds (rugae).
3. These folds contain million fingers like projection called villi.
4. The outer epithelium of villi is made of single layer cell.
5. The epithelium of villi also contains microscopic projection called micro villi.
6. These micro villi increase the surface area for absorption.



7. Inside the villi blood capillaries and lymphatic vessel (lacteal) are present.
8. From villi the sugar, amino acid, vitamins,

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minerals and water and moves to liver through blood capillary.

9. These capillaries open to hepatic portal vein which leads to liver.
10. Fatty acid and glycerol are picked up by lymphatic vessel (lacteal) which pours them into blood stream.

6) Large Intestine:

1. It is the last part of alimentary canal.
2. Its length is about 1.5 meter.
3. There is no digestion of food in large intestine.

Parts of Large Intestine

a. Cecum:

1. It is the first part of large intestine.
2. It starts just after small intestine.
3. Its lengths is 5-8cm.
4. It receives the mixture of food from the small intestine.
5. This mixture contains undigested food, water, some vitamins and salts.

Appendix: It is a small finger like projection in cecum. It plays role in immunity.

b. Colon:

it is the longest part of large intestine. It is divided into four parts:

1. **Ascending colon:** It occurs on the right side of the body and goes up.
 2. **Transverse colon:** It is present below the stomach and cross abdominal cavity.
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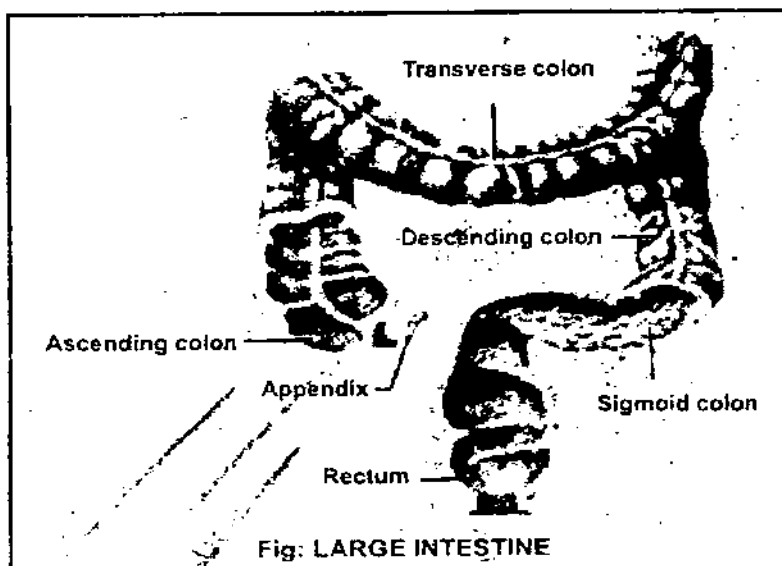
3. Descending colon: It passes down the left side of the body.

4. Sigmoid colon: It is the last part of colon that touches the rectum.

c. Rectum:

1. It is the last part of large intestine.

2. It opens into anus and passes the stool outside from the body (egestion).



Functions of Large Intestine:

1. It absorbs water from chyme.
2. It forms stool.
3. It stores stool.
4. It also removes stool.

Q25: Explain other functions of liver than digestive functions.

Ans: Other Functions of Liver:

1. It stores glucose in the form of glycogen.

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2. It stores fats soluble vitamins.
3. It makes some body proteins.
4. It kills the old RBCs.
5. It makes vitamin-A from carotene.
6. It makes nitrogenous wastes (urea, ammonia and uric acid) from amino acid.
7. It produces heat in cold by increase the rate of metabolism.
8. Liver kills pathogens.
9. It breaks toxic substances like alcohol.

Q26: Explain various disorders of digestive system.

Ans. 1) CONSTIPATION (جذب):

1. It is a condition in which the stool become hard and cannot pass its regular interval.
2. A person is said to be constipated if he/she cannot passes stool from 3 days.

Causes:

1. More use of spicy food
2. Low intake of dietary fibers
3. Low intake of fluids

Symptoms:

1. Abdominal pain
2. Depression
3. Abdominal discomfort
4. Hard stool
5. Dry stool

Treatment:

1. Laxatives like syrup: laxoberon, kolac
2. More fluid intake

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3. Take dietary fiber

2) DIARRHEA (درست):

(BISE Malakand 2014, Mardan 2015)

A condition of increases stool mass fluidity and liquidity. In diarrhea a person can pass stool more than three times a day.

Causes:

1. Bacteria
2. Amoeba
3. Virus

Symptoms:

1. Abdominal pain
2. Nausea
3. Vomiting
4. Sunken eyes
5. Dry skin
6. Low Blood pressure (B.P)

Treatment:

1. Antibiotics (ciproflaxacin)
2. Antiameobic (metronidazole)
3. ORS

3) ULCER:

It is a condition in which the inner lining of stomach dest . . . In this condition a small hole is form in walls of stomach.

Types:

There are two types of ulcer:

- Gastric Ulcer: It occurs in the walls of sto-

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mach.

- Deudinal Ulcer: It occurs in deudinum or esophagus.

Causes:

1. High HCl production
2. Low production of mucus
3. Infection H.pylori
4. Smoking

Symptoms:

1. Stomach pain
2. Heart burn
3. Dyspepsia

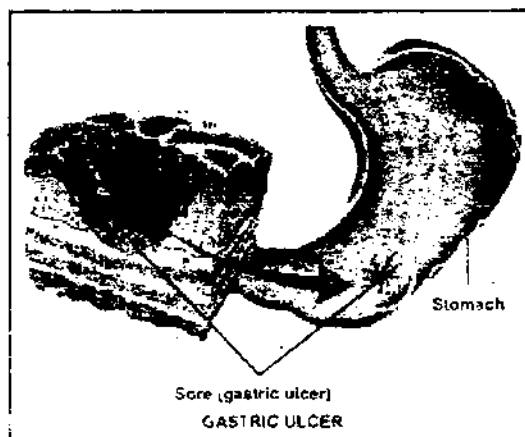
4) Vomating:

Treatment:

1. Antacids (esomeprazole)
2. Antibiotic (ciprofloxacin)

Prevents:

1. Avoid spicy food
2. Stop smoking
3. Avoid stressful life
4. Eat less and it regular travels
5. Exercise
6. Avoid pain killer drugs



EXERCISE

A. Encircle the best suitable answers:

1. The deficiency of which macronutrients causes chlorosis in plants:
(a) Carbon (b) Oxygen
✓ (c) Nitrogen (d) Calcium
2. All of the following are elements that plants need in very small amounts (micronutrients) except:
✓ (a) Hydrogen (b) Iron
(c) Chlorine (d) Copper
3. Which substance, is used by plants to make proteins?
(a) Carbon dioxide (b) Oxygen
✓ (c) Nitrates (d) Vitamins
4. What happens when food reaches the stomach?
(a) No digestion occurs in the stomach
(b) The food moves quickly into the small intestine
✓ (c) Juices mix with the food and stomach muscles squeeze it
(d) The food is completely digested and is absorbed into the circulatory system
5. Which of the following does not manufacture digestive juices?
✓ (a) Esophagus (b) Stomach
(c) Pancreas (d) Intestine
6. What is absorbed from the material when it is in the large intestine?

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- (a) Water (b) Vitamins
(c) Salts ✓ (d) All of these

7. Which of the following is not a function of salivary glands?

- ✓ (a) Start digestion of proteins
(b) Helps in the lubrication
(c) Secrete saliva
(d) Makes taste possible

8. The cardiac sphincter serves as a valve between:

- (a) Stomach and duodenum
✓ (b) Esophagus and stomach
(c) Duodenum and ileum
(d) Jejunum and caecum

9. The function of the liver is to:

- (a) Metabolize carbohydrates, lipids and proteins
(b) Break mature red blood cells
(c) Detoxify the chemicals
✓ (d) All of the above

10. The digestive enzyme pepsin secreted by gastric glands begins the digestion of:

- (a) Carbohydrates ✓ (b) Proteins
(c) Fats (d) Vitamins

Short Questions

B. Write short answers for the following questions:

Q1: List all parts (in order) of the human digestive system through which food passes.

Ans. Digestive System:

"The system that breaks large food molecules into small molecules is called digestive system."

Parts of Digestive System:

1) Mouth:

It contains saliva, teeth and tongue. It helps in taste, grinding and swallowing of food.

2) Pharynx:

It is a muscular pathway in which food goes to esophagus.

3) Esophagus:

It is a muscular tube that connects pharynx to stomach.

4) Stomach:

It is a sac made of muscle. It kills pathogen and store food.

5) Small Intestine:

It is the longest part of digestive system.

6) Large Intestine:

It is the last part of digestive part. It removes undigested food.

Q2: How is food mechanically broken down during digestion?

Ans. Mechanical Digestion:

"The digestion of food without enzymes is called

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mechanical digestion." Mechanical digestion occurs in two places of our digestive system.

1) Oral Cavity:

In oral cavity the food is mechanically digested by teeth.

2) Stomach:

In stomach food is retained for more time. Due to churning movement of stomach the food is mechanically digested. The walls of stomach are enough strong for mechanical digestion.

Q3: How does the digestion and absorption of fats differ from the digestion and absorption of carbohydrates and proteins?

Ans: 1) Digestion and Absorption of Fats:

1. *Digestion of fats starts in small intestine.*
2. *Biles from liver break the fats into small droplets.*
3. *Lipase of pancreatic juice converts fats into fatty acids and glycerol.*
4. *It is absorbed by lymphatic vessel that joins to blood.*

2) Digestion of Proteins:

1. *Digestion of protein starts in stomach.*
2. *Pepsin presents in stomach convert proteins into peptides or amino acids.*
3. *Pancreatic juice also called trypsin that acts on proteins and digest it.*

3) Digestion of Carbohydrates:

1. *The digestion of carbohydrates starts in mouth.*
2. *Mouth contains amylase that digests carbohydrates.*
3. *Amylase is also present in pancreatic juice that*

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digests carbohydrates.

4. *It is absorbed by blood capillaries from intestine and comes to liver the hepatic portal duct.*

Q4: Enlist five environmental hazards related to the use of fertilizers.

(BISE Bannu 2014, Kohat, Abbottabad 2015)

Ans. Fertilizers:

"Those substances which increase the fertility of soil are called fertilizers."

Hazards of Fertilizer:

1. *It increases the concentration of salt in soil which leads to improper growth of plants.*
2. *Bad smell from fertilizer effects the quality of air.*
3. *It pollutes underground water.*
4. *It causes eutrophication.*
5. *Manure may contains pathogens that causes disease in plants.*

Q5: What is malnutrition? Why it is considered to be a health hazard?

Ans. Malnutrition:

1. *It is a condition that results from diet that contains too low or much nutrients.*
2. *It is considered to be health hazards because it results in various diseases like obesity, heart disease and constipation etc.*

Q6: Discuss the role of dietary fiber in balanced diet. (BISE Malakand 2014, Abbottabad 2015)

Ans. Dietary Fibers: *"The undigested food mater*

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rials are called dietary fibers."

1. It prevents constipation.
2. It controls weight loss by creating the feeling of fullness.
3. It lowers the level of cholesterol in blood.

Long Questions

C. Write detailed answers for the following questions:

Q1: Overtake of nutrition can lead to serious health disorders. Evaluate the statement by giving examples.

Ans: Please see Question number 27 (OIN).

Q2: List down major enzymes in the human digestive system. Elaborate their role in digestion.

Ans: Major enzyme of digestive system and its functions:

1) Amylase:

Breaks polysaccharides into disaccharides and monosaccharide.

2) Pepsin:

It converts protein into amino acids.

3) Trypsin:

It is present in small intestine. It converts partially digested protein into amino acids.

4) Lipase:

It converts lipids into fatty acids and glycerol.

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5) Sucrose:

It converts sucrose into fructose and glucose.

6) Maltose:

It converts maltose into glucose + glucose.

Q3: Explain the important of water in the human body.

Ans. Please see Question number 17.

Q4: Explain the role of oral cavity and pharynx in the digestive system.

Ans. Please see Question number 29.

Q5: Describe the structure of a villus, including the roles of capillaries and lacteals.

Ans. See absorption of food in small intestine.

